Issue: Screw Machine Tooling • Applications • Methods • Equipment

The Magazine of

MAY, 1952

TOOLING and PRODUCTION

TOOL & DIE JOURNAL

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THREE Reasons Why
1 Reduce set-up and change-over time required on large tapered shank tools.
2 Versatility—drilling, reaming and other operations can be done with same set-up, using Postiv-Lok adapters.
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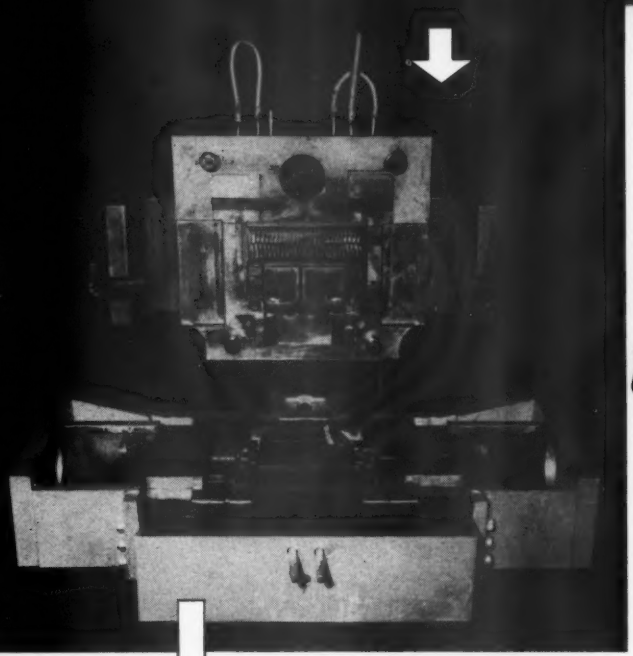

No matter what your DIE-CASTING JOB may be...

Accuracy calls for POTOMAC M Hot Work Die Steel

"HOT-WORK STEELS"

is the title of a new, six-page folder that tells about the chromium, molybdenum, vanadium Hot Die Steel known as POTOMAC M—and also covers other grades for other hot-work operations. Secure your copy—*write today!*

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In the precision casting of aluminum, POTOMAC M Hot-Work Die Steel is especially favored as the material for die-casting dies because its properties help assure accuracy of the steel itself *after* heat treatment. Die makers have found that size changes are held to a minimum. Dimensional stability is thus the *first* contribution that POTOMAC M makes to accuracy.

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Allegheny Ludlum makes a complete line of steels for hot-work tooling of various kinds—so, whether your need is the mass producing of duplicate parts or fabricating a few of them, call up or write "A-L" every time for hot-work counsel or service or both. Just tell us your requirements.

Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

For complete MODERN Tooling, call

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AL FINE TOOL STEELS SINCE 1854

The Super-Speed Air Motor mounted on a Bellows Air Motor Arbor Stand at Carmel Screw Products Co., Carmel, Ind. Inserting the part in the fixture trips the micro-switch to advance the piston, stamping the part number in the steel rod.

SMALL AIR CYLINDER
Packs Powerful Punch

At 100 lbs. air line pressure this Super-Speed 2½" bore Bellows Air Motor develops enough force to punch a ½" diameter hole through $\frac{1}{16}$" thick mild steel. The speed of the piston rod is six to ten times the maximum speed of a standard air cylinder of the same bore.

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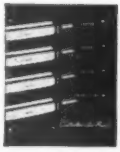
The Super-Speed Bellows Air Motor comes complete with either a built-in manually operated valve or the Bellows Electroaire electrically-controlled valve, with or without safety controls. Standard stroke length: 2", 2½",4", 6", 9" and 12".

To learn more about the many ways you can use the wide range of Bellows "Controlled-Air-Power" Devices write for this free book. Ask for Bulletin CL-30. Dept. T&P552



The Bellows Co.
Akron 9, Ohio

1381

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The Magazine of

TOOLING and PRODUCTION

TOOL & DIE JOURNAL

1975 Lee Road • CLEVELAND 18, OHIO

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These men, from whom emanate recommendations, requisitions and orders for needed materials, tools, equipment and accessories, comprise the Cycles of Buying Influence within their respective plants—CBI—and it is they who constitute TOOLING and PRODUCTION'S ever-vital reader circulation.

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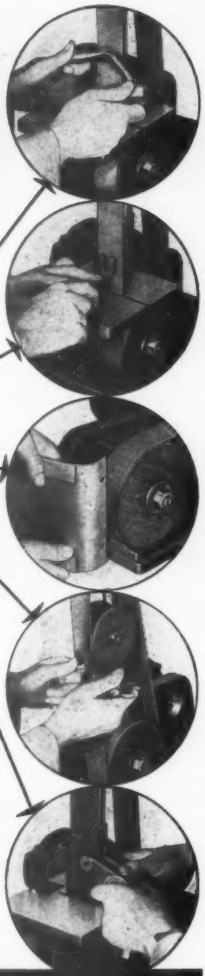

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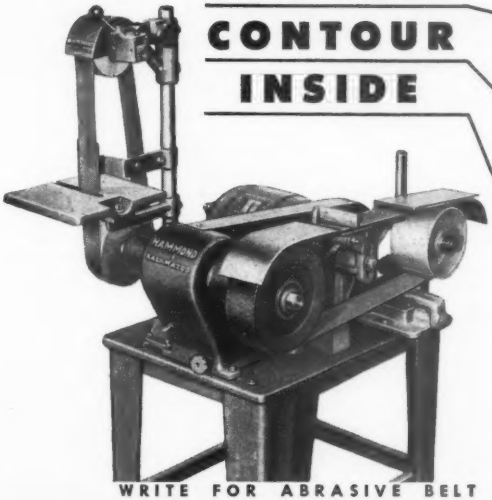

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GRINDER-POLISHER CATALOG NO. 75

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1631 DOUGLAS AVENUE • KALAMAZOO MICHIGAN

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SHEARING and FORMING a GIANT

The Story of a Team

Steel sheets for these Giant Marion Shovels are formed with great accuracy on a Cincinnati 210 Series Brake. The blanks sheared square and true on a Cincinnati 100 Series Shear contribute to this accurate forming that speeds and simplifies assembly.

This Cincinnati Brake, with 16 feet of die surface, is forming $\frac{3}{8}$" plate into lower frame pieces. The one inch capacity shear is cutting $\frac{3}{4}$" plates for the shovel platform or upper deck.

Save time, save money with this dependable Cincinnati Team.

Write for Shear Catalog S-6 and Brake Catalog B-3.

The Marion 5561, World's Largest Mobile Land Product, with a 45 cubic yard shovel. Photos—Courtesy of Marion Power Shovel Co., Marion, Ohio.

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Ex-Cell-O builds a complete line of tool grinders for sharpening high speed steel, cast alloy, and carbide tools. All are double-end grinders with generously proportioned tool rest tables, and all are equipped for face grinding on cup type wheels. For accurate finishing of small tools or for fast metal removal on large tools there's an Ex-Cell-O Tool Grinder to suit your needs. They are described and illustrated in Bulletin 46262. Write to Ex-Cell-O in Detroit today for your free copy. No obligaton, of course.

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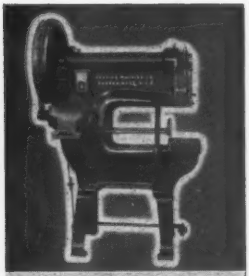

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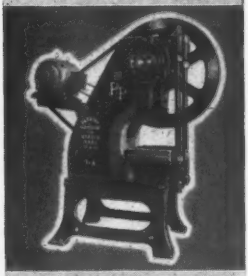

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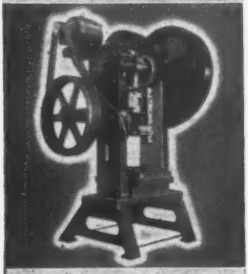

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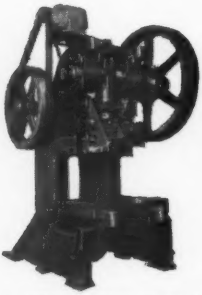

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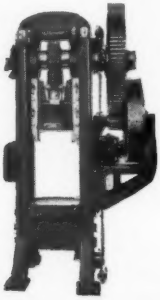

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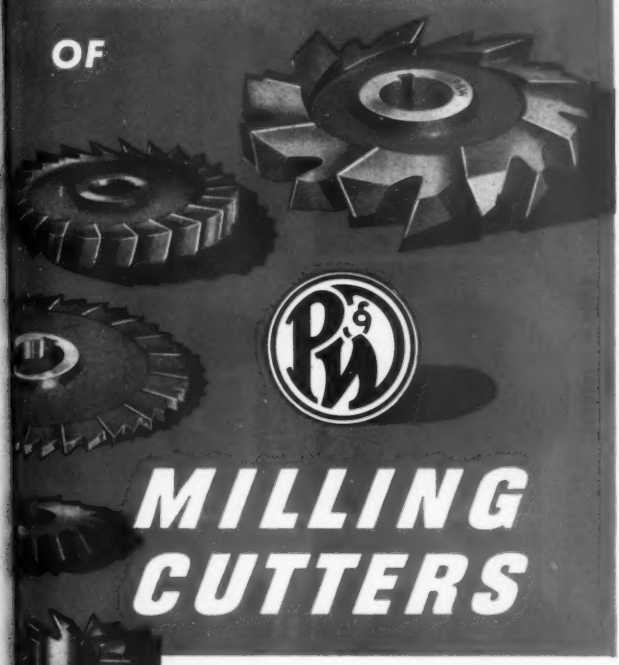

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MANY TYPES

PRATT & WHITNEY PLAIN MILLING CUTTERS — sturdy construction for heavy duty work plus ample chip room.

PRATT & WHITNEY STAGGERED TOOTH T SLOT CUTTERS

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PRATT & WHITNEY MULTIPLE THREAD CUTTERS — for maximum economy on high production jobs.

PRATT & WHITNEY "HI-HELIX" END MILLS — high speed steel only—for general production end milling work.

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PORTABLE GRINDING

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Bring them to Barth!

WHEN YOU ARE FACED with a really big planing job . . . think of this large planer which is ready to go to work for you. Here's another "eye opener" as to the complete equipment available to you at Barth's. Come out and look around . . . it can prove profitable to know the broad scope of Barth's facilities in equipment, engineering and production.

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BARTH STAMPING & MACHINE WORKS,

12650 Brookpark Road, Cleveland 29,

DESIGNERS AND BUILDERS OF DIES, TOOLS AND SPECIAL MACHIN

Lower unit costs are yours with Dickerman. Assuring longer die life and fewer regrinds, Rol-di-Feed operates accurately and automatically – greatly reducing the number of blanks and rejects encountered in what is now your standard production set-up. This all adds up to Dickerman Die Feeds doing work equivalent to five workmen.

Write for detailed information today

H. E. DICKERMAN MFG. COMPANY Dept. E323 Albany Street • Springfield, Mass.

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Over 300,000 circulation this issue.

NEWS gleaned from largest selection of Swiss Precision Machine Tools in the U.S.

HIRSCHMANN HIGHLIGHTS

ABOUT PRECISION MACHINE TOOLS

PUBLISHED BY CARL HIRSCHMANN COMPANY, MANHASSET • LOS ANGELES • MILWAUKEE — MAY, 1952

NEW WESTERN BRANCH

Largest selection of modern high precision Swiss machine tools displayed on the West Coast is at 5124 Pacific Boulevard, Los Angeles, Western Branch of Carl Hirschmann Co., whose executive offices are at 30 Park Avenue, Manhasset, N.Y.

NEW MIDWEST BRANCH

Showrooms and warehouse for complete machines, spare parts and factory service for all lines exclusively represented in U.S. by Carl Hirschmann Co., is being developed at 525 E.Michigan Street, Milwaukee. Russell T. Gilman is Executive Director.

PRECISION BALL BEARING MANUFACTURING

Precision Ball Bearing Manufacturers have taken a decided interest in Tornos Automatics for bearing races manufacture. Tornos Machines, slower than multiples, have proven to make up lost time by reducing and eliminating secondary operations.

AIRCRAFT INSTRUMENTATION

Leading U.S. instrument makers use Hauser Burnishing Machines for much of their super finishing work on small parts. The new Hauser Super Finishing Method with especially developed ceramic wheels has found many suitable and cost-cutting applications in the instrument field.

SWISS MACHINES TO U.S. STANDARD

Hirschmann disregarding additional manufacturing costs, is striving more and more to adapt Swiss machines to U.S. Standards. Most of their machines are not only built to such standards but also are equipped with U.S. fuse boxes, belts, switches and standard precision ball bearings.

AIR SHIPMENTS

In many emergency cases Hirschmann has made delivery of medium sized machine tools (2000 lbs) from Switzerland to Midwestern factories in 48 hours via transatlantic air freight service. Through special assistance by U.S. customs, air shipments are cleared with only a few hours delay in New York.

CAM AND TOOL SERVICE

Complete cam and tool service for Automatics is obtainable directly from Manhasset. Factory trained Hirschmann specialists assure accurate and prompt service.

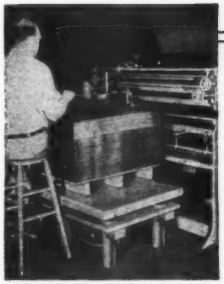
DIAMOND WHEELS

Hirschmann has secured considerable quantities of diamond wheels, which are adaptable for most standard machines. Prices are somewhat above domestic wheels due to the fact that in Switzerland the diamond market is still operating on free market.

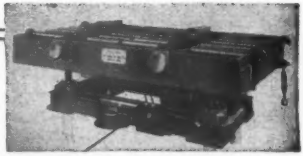
SPARE PARTS

Carried in stock at 30 Park Avenue, Manhasset, N.Y., is most every spare part necessary for Hirschmann machines. Large quantities of collets and carbide tools of every bore and size also are standard stock items.

If you want the complete issue of HIRSCHMANN HIGHLIGHTS regularly, write Carl Hirschmann Co., 30 Park Ave., Manhasset, N. Y.



Portelvator, stationary installation, automatic, self-leveling, for sheet feeding operation.



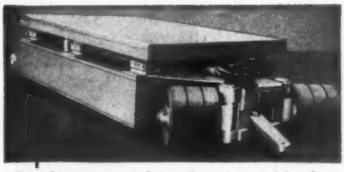
Portelvator, twenty-five ton capacity, roller top, self-loading and self-discharging, for die transfer.

SAFE AND ACCURATE LIFTING—LEVELING

Hamilton Industrial Elevating Tables, which embody the safe and accurate Portelvator© lift principle, have attained wide use in die transfer, stock positioning, elevating, and leveling. Built to meet each users requirements, they may be manually or electrically operated; controls may be hand or foot operated, or completely automatic; size, shape, capacity, lift, and installation details may be varied at will. Characteristics such as roller-conveyor tops, tilt tops, and the like, may also be incorporated.

If your job involves lifting, leveling, or transporting, of out-size or unusual nature, our experience in solving just such problems is at your disposal. **Write for Bulletin P-501.**

SAFETY of OPERATION is inherent in the PORTELVATOR© mechanical lift principle, which transmits power through worm, worm gear, and screw.



Portelvator, portable elevating table for movement of automobile body dies.

Portelvator, built for basement installation to supply extra high lift at ground level.

THE *Hamilton* TOOL COMPANY

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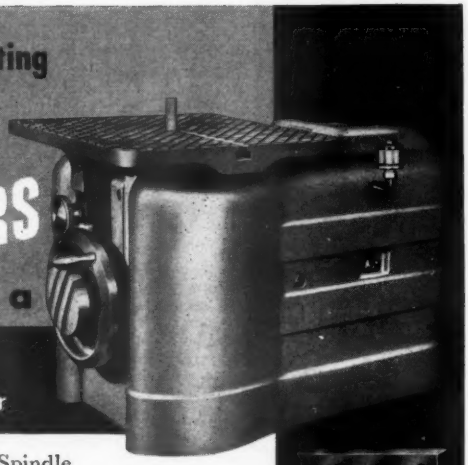
is EASY with a

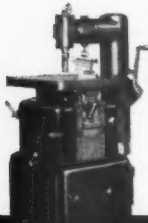
BOYAR-SCHULTZ
No. 1 Profile Grinder



A Bench model with Spindle speed of 20,000 R.P.M., Boyar-Schultz No. 1 Profile Grinder is a rapid Stock remover.

An ideal machine tool for grinding and fitting irregular inside and outside contours and profiles such as die clearances and other many grinding jobs that would otherwise require time consuming set-ups. A real time-saver, performing in minutes many jobs that formerly required hours.

Accommodates wheels 1/8" to 1" diameters.



Boyar-Schultz
No. 2 Profile Grinder

For grinding and fitting large dies and punches such as forming dies for refrigerators, tables, sanitary ware and other large work. Spindles turn at 10,000 R.P.M. Accommodates wheels 1/4" to 3" diameters.

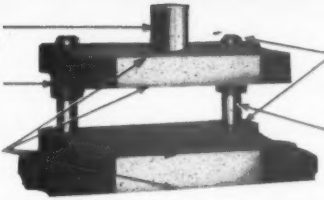
BOYAR-SCHULTZ CORPORATION

2112 Walnut Street • Chicago 12, Illinois

YOU PAY FOR THE BEST . . .
BE SURE YOU GET THE BEST

FACTORY-BUILT IS BETTER-BUILT

When you specify "Detroit" die sets, you are assured micro-metric precision that means: 1) Lower costs in mounting die in die set and 2) Longer, trouble-free production runs. Factory-built die sets give you what you pay for—parallelism, squareness and finish.


Shanks cast-on, inserted or welded
"Detroit" bushings are full-bearing
Parallel surfaces held to exceptionally close limits
Leader pin holes and bushing holes are micro-metric jig bored
"Detroit" precision leader pins are superfinished

Factory-built to the most exacting standards, "Detroit" die sets are also factory-assembled and factory-inspected. You don't have to re-work "Detroit" die sets in your shop to get the accuracy and performance you have a right to expect.

For prompt factory delivery, call "Detroit"

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DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICH.

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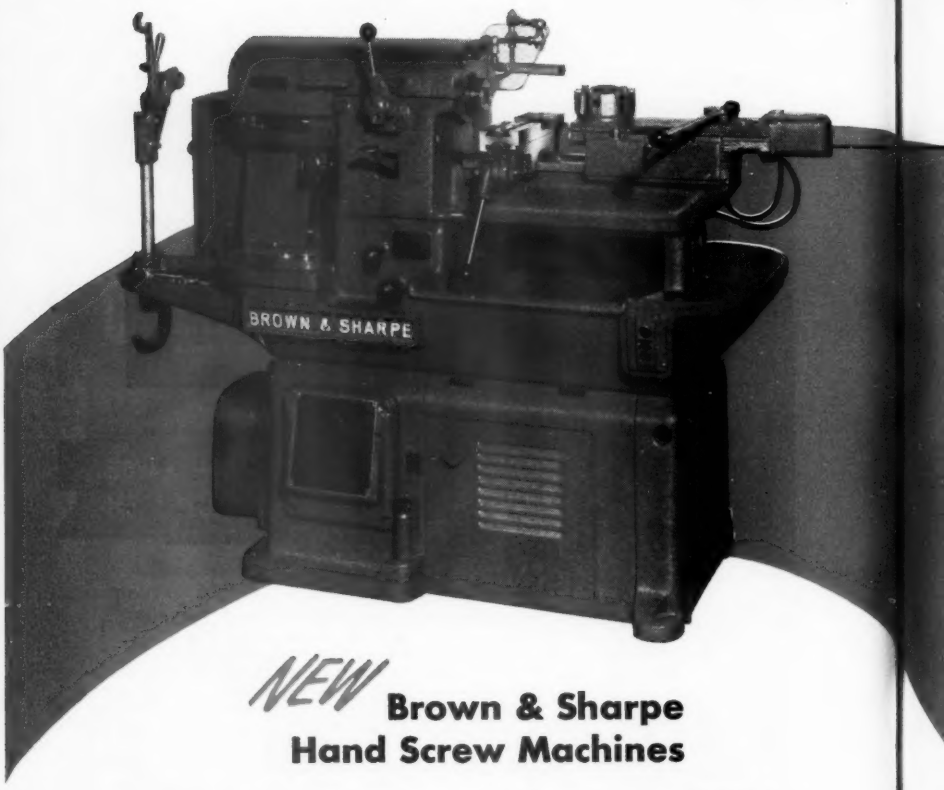


NEW **Brown & Sharpe Hand Screw Machines**

Handle Short-Run Jobs More Profitably!

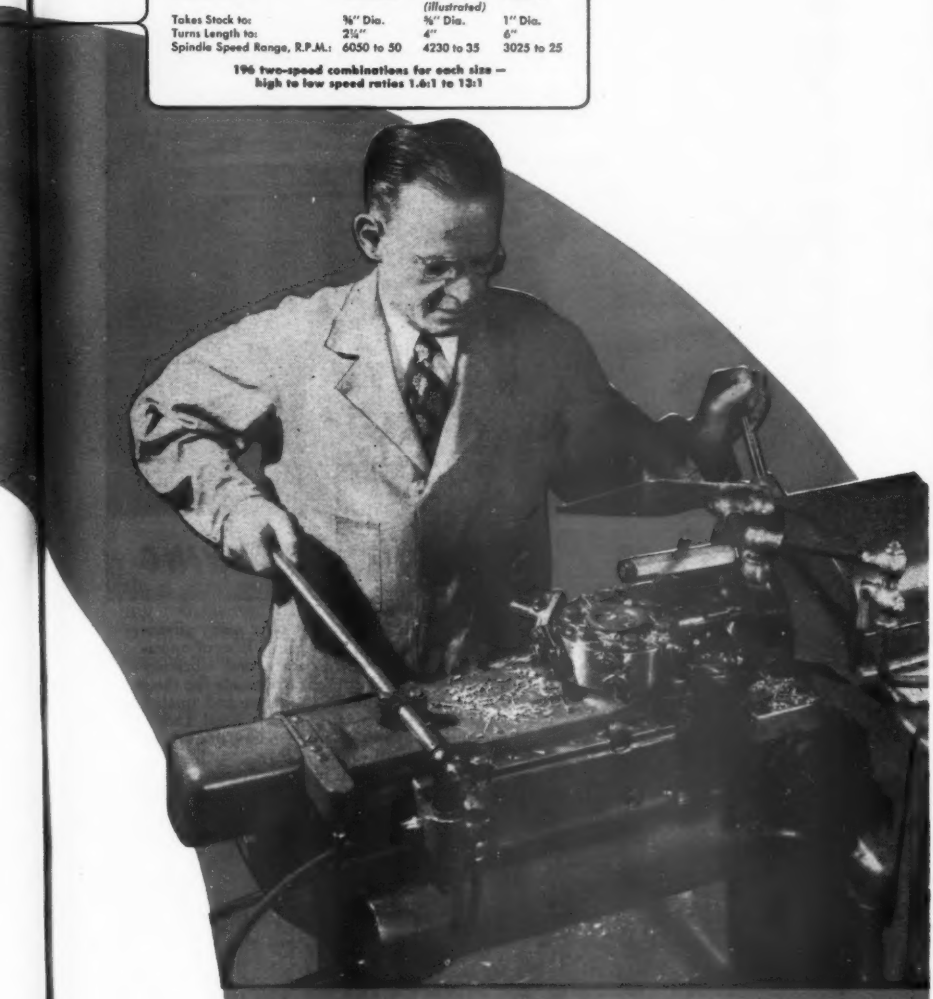
Three new Brown & Sharpe Hand Screw Machines now offer you high economy and efficiency in small-quantity bar-stock and 2nd operation work . . . and save the necessity of interrupting long-run jobs on your automatics. Set-up is fast, without cams or timing for automatic functions.

Advanced efficiency features include: anti-friction-bearing spindles . . . chain drive on spindle at all speeds . . . completely enclosed driving mechanism . . . automatic lubrication of practically all mechanisms and bearing surfaces.

Write for detailed literature on these modern, cost-cutting machines. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

3 SIZES:	No. 00	No. 0 *(illustrated)*	No. 2
Takes Stock to:	⅝" Dia.	⅝" Dia.	1" Dia.
Turns Length to:	2¼"	4"	6"
Spindle Speed Range, R.P.M.:	6050 to 50	4230 to 35	3025 to 25

196 two-speed combinations for each size — high to low speed ratios 1.6:1 to 13:1



Brown & Sharpe B&S

FOR FAST, PRECISION MACHINING

SPECIFICATIONS

Swing over bed and saddle .... 14-5/8"
Distance between centers 24½ to 60½"
Maximum Collet Capacity ..... 1"
Spindle Speeds ... 8—27 to 800 r.p.m.
Power Longitudinal Feeds, 48 R. H. or L. H. ..... .0015 to .0841"
Power Cross Feeds .. 48, .0006 to .0312"
Thread Cutting, 48 R. H. or L. H. pitches ..... 4 to 224 per inch

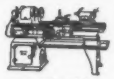
South Bend 14½" Lathes offer many advantages for precision machining. Ease of operation, speed, power, accuracy, and efficiency are some of the features responsible for their popularity. Often the precision and quality of finish obtained with South Bend Lathes are such that subsequent grinding, honing, or lapping operations are unnecessary. Substantial savings in capital investment, power consumption, floor space, and labor costs have resulted from their installation.

SEND INFORMATION CHECKED:

☐ _____

_____

☐ 9" and 10" BENCH LATHES


☐ 10" to 16-36" FLOOR LATHES

☐ ½" and 1" Collet TURRET LATHES

☐ 14" DRILL PRESSES

☐ 7" BENCH SHAPERS

Name _____ Company _____

Street _____ City & State _____

Building Better Tools Since 1906 • SOUTH BEND LATHE • South Bend 22, Indiana

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

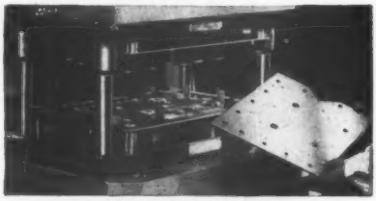
New • Fast • Proven

LOW COST methods for PERFORATING and NOTCHING SHEET METALS

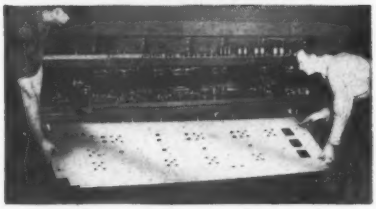
Both methods feature: LOW DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION** – Down time is minutes as compared to hours for changeover. For precision work in all types and sizes of presses. **START PRODUCTION *at once.*** Pierce up to ¼" thick mild steel. Saving money in the best known plants.

Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized units hold the retainers. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on ⅛" steel perforating and notching job, using Tee slotted die set. With Whistler Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.



Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

NAME

FIRM

ADDRESS

CITY ZONE STATE

S. B. WHISTLER & SONS, Inc.

Adjustable, Magnetic, Custom and Cam Dies for all Industry

748 Military Road **Buffalo 23, New York**

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

DIRT WIPER SEALS
HARD CHROME PLATED PISTON RODS
SOLID STEEL HEADS, CAPS and MOUNTINGS from MACHINED SOLID BAR STOCK
STANDARD LEATHER CUP SEAL ASSEMBLY SHOWN IS INTERCHANGEABLE WITH STANDARD PISTON RING PISTON ASSEMBLY
MILLER
High Pressure
HYDRAULIC CYLINDERS

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

STANDARD INTERCHANGEABLE PISTON ASSEM

High Pressure

HYDRAULIC CYLINDERS

Meet J. I. C. HYDRAULIC STANDARDS

Write for FREE copy of these "Standards"

Years before the Joint Industry Conference (J. I. C.) Standards for specifying "quality" hydraulic equipment were adopted, the *standard* design and construction features of Miller High Pressure Hydraulic (2000-3500 psi) Cylinders already included ALL the specifications for cylinders, seals and pistons now called for by the "Standards". Hard chrome plated, scratch-resistant piston rods and dirt wipers have long been standard Miller cylinder features yet are required by the "Standards" only under severe conditions.

Solid steel heads, caps and mountings which eliminate costly, dangerous breakage even under the severest operating conditions represent an "extra-quality" standard Miller cylinder feature which actually exceeds the high quality set by the J. I. C. Standards.

The Miller "Patented" Hydraulic Piston Rod Seal which has no manual adjustment and is automatically self-adjusting and wear-compensating to give life-long leakproof service without ever requiring any manual adjustment whatsoever . . . far surpasses the requirement of J. I. C. Standard H6.2.5 which specifies "Stuffing boxes for automatic packing shall be so designed as to prevent adjustment beyond the functional limits of the packing"

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

MILLER MOTOR COMPANY

2046 N. HAWTHORNE • MELROSE PARK, ILLINOIS

AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS · COUNTERBALANCE CYLINDERS · BOOSTERS · AIR VALVES

CLEVELAND — PITTSBURGH — PHILADELPHIA — DETROIT — YOUNGSTOWN — BOSTON
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ST. LOUIS and OTHER AREAS.

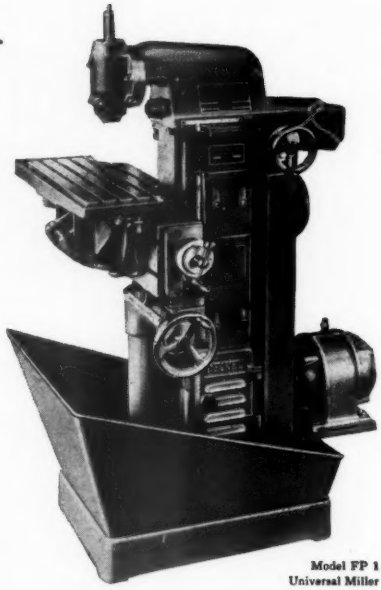
Sales and Service from coast to coast

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

DECKEL UNIVERSAL MILLERS

for Horizontal / Vertical / Angular / Spiral — Milling

Drilling / Boring / Slotting — Operations



Model FP 1 Universal Miller

The Deckel FP 1 UNIVERSAL MILLER, with its various attachments, work holders and indexing fixtures, makes it easy and economical to produce many types of work pieces on a single job or mass production basis. Work pieces can be machined in one set-up and without the use of elaborate tools, jigs or fixtures.

Basic features of the FP 1 include heavy column, adjustable guide ways and spindles, large graduated scales, high precision measuring equipment, convenient location of operating controls, directional single lever control of automatic table feeds and ample power for removing metal at a high rate.

SEE THESE MACHINES IN OPERATION AT COSA'S NEW YORK SHOW ROOM OR SEND FOR DESCRIPTIVE LITERATURE

Other Deckel Machines for Tooling and Production
2 DIMENSIONAL ENGRAVERS
3 DIMENSIONAL ENGRAVERS
UNIVERSAL PANTOGRAPH DIE SINKERS
UNIVERSAL TOOL & CUTTER GRINDERS

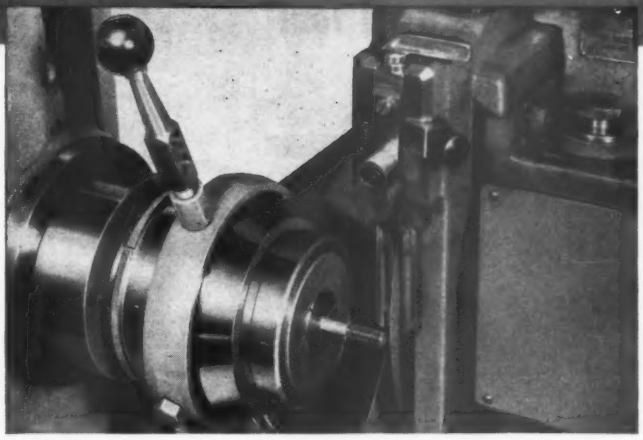
COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools— from Small Bench Lathes to Large Boring Mills

IN DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

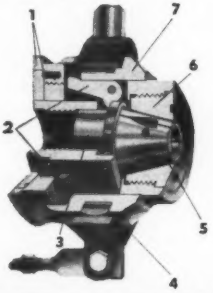
Get a better grip on production

Levermatic COLLET CHUCK



2" Levermatic Chuck on a thread grinder. Note length of piece from nose of collet to grinding wheel. Extreme accuracy was still obtained. Eliminated grinding between centers on short pieces.

The Levermatic provides *instant* internal and external gripping and releasing. Faster, more accurate machining at lower costs! For engine, toolroom and turret lathes, milling machines, drill presses, grinders, etc.



1. Selective pressure adjusting ring with positive ball detent lock.
2. Hardened cam levers (three).
3. Collet pusher sleeve.
4. Self-lubricating bronze yoke shoe.
5. The new Co-netic Collet—new parallel grip design.
6. Precision ground collet closing ring.
7. Positive cam closing collar.

SUTTON TOOL COMPANY
Dept. TP-5 Sturgis, Michigan

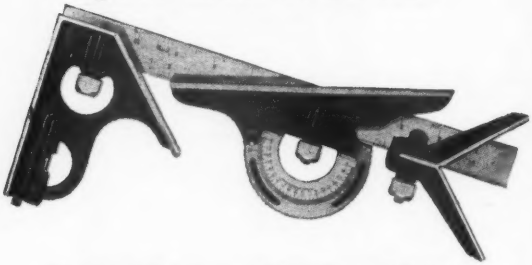
SUTTON TOOLS

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

TUMICO

Combination Sets

"your most used tool"



Used as a Try Square, Miter Square, Height Gage, Marking Gage, Depth Gage, Center Finder, Protractor, Bevel Gage, Scriber, Level, Steel Rule, and Straight Edge; the versatile Tumico Combination Set is your best tool buy. The bevel protractor is reversible. The blade, drop forged square, and center head are hardened. All parts of the set are accurately ground. It performs the duties of many tools, saves time, space and money. Write for new catalog.

TUBULAR MICROMETER CO.

ST. JAMES, MINNESOTA

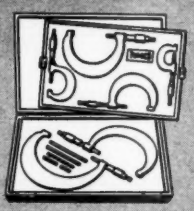
SEATTLE • LOS ANGELES • DENVER • DALLAS • CHICAGO • MINNEAPOLIS • KANSAS CITY
DETROIT • ATLANTA • NEW YORK • TORONTO, CANADA • EXPORT OFFICE: CHICAGO

FOR EVERY JOB

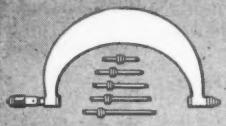
TUMICO

PRECISION MEASURING INSTRUMENTS

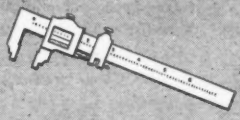
TUMICO POST GAGES
Precision micrometer or dial indicator instruments adaptable to a wide variety of uses. 10 models.



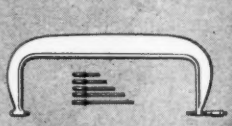
TUMICO MICROMETER SETS
Complete sets for a broad range of accurate measurement operations. From 0" to 30" in 1" steps.



TUMICO
OVER-THE-BAR MICROMETERS
Precision bore measurement without removing boring bar. 11 models from 3" to 28".



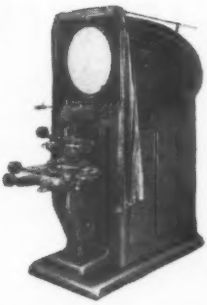
TUMICO VERNIER CALIPERS
Precision made. Accurate, clearly etched graduations and numerals. 24 models from 6" to 48".



TUMICO BAR MICROMETERS
Provide a wide range of precision measurement with low investment. 30 models from 6" to 168".

which of these 3 optical aids answers Your PRECISION PRODUCTION PROBLEM ?

1



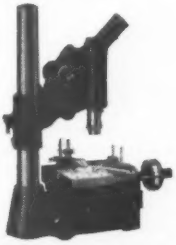
CONTOUR MEASURING PROJECTOR—You save time and money by spotting inaccuracies quickly and simply . . . with higher precision measurements than any other projector can give you. You get angular measurements to ± 1 minute of arc with a protractor screen, and direct linear measurements to ± .0001″ over a range of 4″ by 6″ with the cross slide stage. Dimensions, angles and profiles of production-run parts can be compared directly with a *traced* outline of the projected image of the master part, or with a scale drawing superimposed on the screen. Write for Catalog D-27.

2

STEREOMICROSCOPES

The finest optical system ever produced for stereoscopic work assures you precision accuracy in small parts assembly operations and in inspection of tools and finished parts. You get clear, sharp, three-dimensional images, and a *wider critical focus than ever before.* The *unreversed,* magnified image is more easily interpreted by the average user. These sturdy, dustproof microscopes are extensively used in industry, either alone or incorporated into machine tools. Write for Catalog D-15.

3



TOOLMAKERS' MICROSCOPE

This sturdy microscope gives you one inch linear measurements to ±.0001″ and angular measurements (with protractor eyepiece) to ± 1 minute of arc. Operation is extremely *simple* and *fast.* Opaque and transparent objects of any contour can be measured.

Catalog D-22.

WRITE for complete information on these three important optical aids designed to save you time and money. You may be paying many times over their moderate cost in lost time and rejects. Bausch & Lomb Optical Co., 79805 St. Paul St., Rochester 2, N.Y.

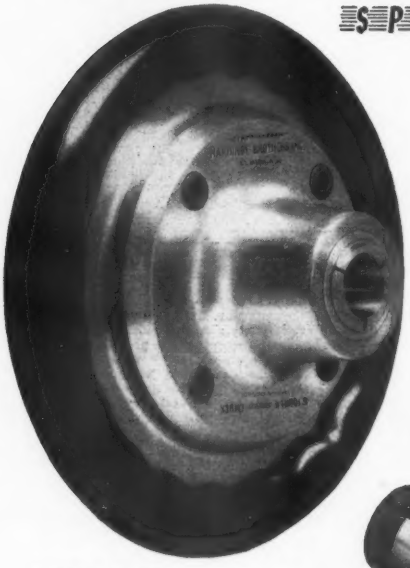
Bausch & Lomb *Quality Control* Instruments

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

HARDINGE-SJOGREN SPEED

HARDINGE
ELMIRA, N.Y.

Collet Chucks with HARDINGE STEEL COLLETS



Available in Five Sizes:
1", 1⅜", 1¾", 2¼", and 3½" collet capacity.

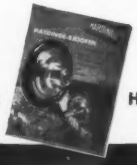
for Accuracy and Durability at Low Cost

When you order Hardinge-Sjogren Chucks and Hardinge Steel Collets you get all these advantages:

1. Complete Capacity for Hexagon and Square as well as Round.
2. Lowest Initial Cost.
3. Longest Service Life.
4. Grips both short and long lengths properly.

. . . . . and HARDINGE tempered steel collets assure you of quick release, sustained accuracy and durability.

Write for Bulletin 8— complete information on



HARDINGE-SJOGREN Chucks and Collets.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

RELENTLESS PRODUCTION SCHEDULES
and
SMALL PRECISION GEARS

•

FEELING FUTILE?

Unusual conditions are usual now. You are *expected* to build small, precision mechanisms on fast production schedules. And you will be expected to produce them better and faster tomorrow. But why worry? All you will need will be better machines.

MORALE BOOSTER

And better machines are here *now!* The Hamilton No. I Precision Small Gear Hobber will *solve* your problem in respect to gears. All gears, regardless of shape, if they are small and exact, can be produced faster on the Hamilton No. I.

FREE HELP

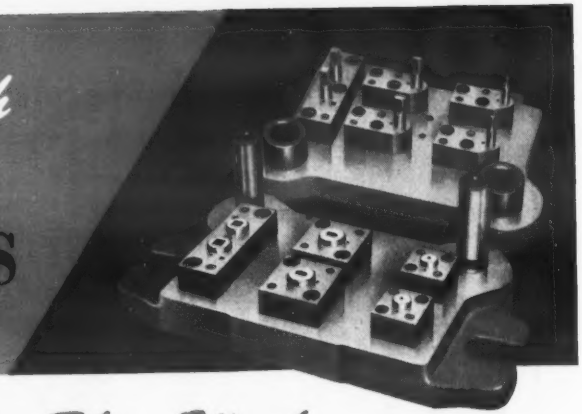
You don't expect full information about such a machine in the small space of one advertisement. But full information is available . . . ten printed pages of it . . . and offered to you free. Write for our Bulletin No. H-492, with supplement. Do it now . . . tomorrow you may need to *know!*

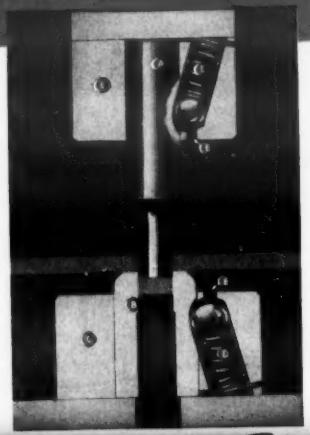
THE *Hamilton* TOOL COMPANY
832 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

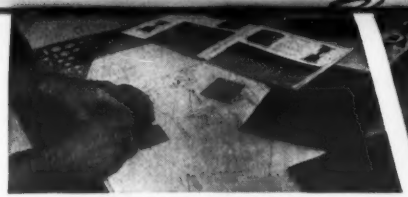
You Save Time with
R-B
PUNCHES and DIES





How They Work . . .

R-B punches (A) and die buttons (B) are locked in standard or special retainers (C) which are mounted on the die shoes. A spring-loaded ball lock (D) produces positive radial alignment and vertical locking; *no additional keying is necessary regardless of the size or shape of the punch.* Up to ¾″ stock can be pierced. R-B punches and dies are easy to insert; push and twist and they're locked. They're easily removed, too. Retainer holes (E) provide for insertion of tanged tool which releases ball and allows instant removal.



IN DIE DESIGNING

R-B standardized retainers are available in three shapes and many sizes, and where necessary, R-B special retainers can be supplied. You save "time on the board" because you are working with *standardized* equipment.

IN DIE CONSTRUCTION

R-B punch and die retainers and special retainers are quickly, easily and accurately mounted without special machining. With them, you can save much of your skilled die-makers' time.

IN DIE OPERATION

HERE'S WHERE YOU *REALLY* SAVE. R-B punches and dies cut press down time for replacement to a minimum. They're instantly removed—quickly changed—yet accurately aligned when locked.

TOOL STANDARDIZATION IS THE BASIS FOR EFFICIENT AND ECONOMICAL PRODUCTION. WITH R-B YOU GET THE ACCEPTED STANDARD OF THE SHEET METAL INDUSTRY—IN STANDARD DESIGN FEATURES THAT SAVE IN ENGINEERING, DIE CONSTRUCTION AND OPERATION.

ALLIED PRODUCTS CORPORATION
RICHARD BROTHERS DIVISION
DEPT. No. 63 • 12635 BURT ROAD • DETROIT 23, MICHIGAN

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COMPANY_____

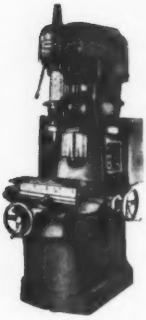
ADDRESS_____

CITY_____ ZONE____ STATE_____

Also Produced in
ALLIED'S FOUR PLANTS
HARDENED AND PRECISION GROUND PARTS • STANDARD CAP SCREWS • SPECIAL COLD FORGED PARTS • SHEET METAL DIES • ALLITE DIES CAST OF ZINC ALLOY • JIGS • FIXTURES

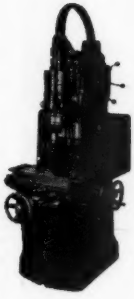
SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

NOW IS THE TIME TO PLAN AHEAD

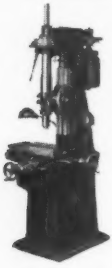


No. 2 MOORE JIG BORER, with its accurate lead screw settings within .0001", offers all the time-proven precision features associated with Moore Jig Borer construction for 15 years, plus numerous labor-saving advantages, including: increased capacity and size; infinitely variable spindle speeds; 3 power feed ratios; centralized controls.

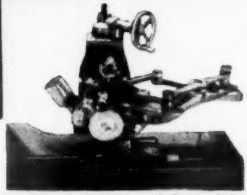
No. 2 MOORE JIG GRINDER. With this new and larger Moore Jig Grinder, *regular and irregular contours* are ground to size and location after hardening. This extends the Jig Grinder's traditional function of relocating straight and tapered holes. Holes from ⅛" to 8" can be relocated and ground within .0001"—by power or hand feed.



Four ways to cut costs and meet competition by mechanizing your toolroom.



No. 1 MOORE JIG BORER remains in the line. For its range—table working surface of 10" by 16" and cuts up to 3½"—this machine is still an ideal buy. There are over 1000 satisfied users. We will continue to offer it for the many situations where a small, accurate jig borer fills the required prescription.



MOORE PANTO-CRUSH WHEEL DRESSER speeds form-grinding and cuts costs. Both crush-forming and diamond-dressing are accomplished with this 2-in-1 unit permanently mounted on the wheel spindle of a surface grinder. You switch from one method to the other without disturbing workpiece setting.

We'll be glad to send you complete descriptive literature on any of these machines.

MOORE SPECIAL TOOL COMPANY, INC.
726 Union Ave., Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • DIE FLIPPERS • MOTORIZED CENTERS • HOLE LOCATION ACCESSORIES

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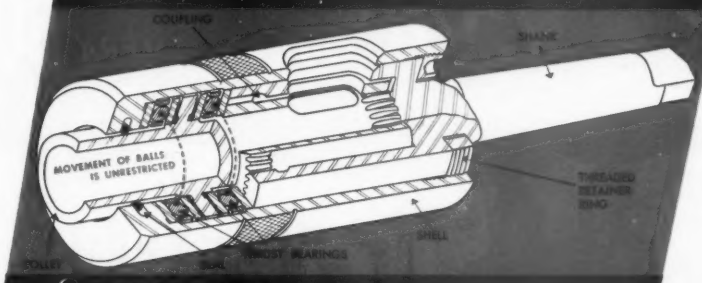
for ACCURATE drilling · reaming · tapping



Use SJ SCULLY-JONES

"JA" FLOATING HOLDERS

Get these advantages . . . *proven in the field:*

UNIFORM CUTTING OPERATIONS

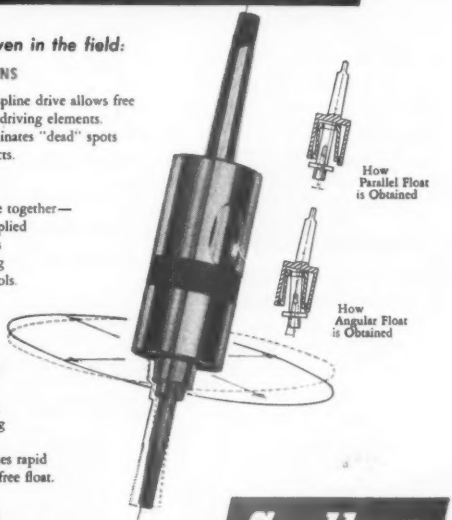
Clearance in the double-gear spline drive allows free movement of the floating and driving elements. This prevents binding and eliminates "dead" spots or zones which often cause rejects.

CONTINUOUS PRODUCTION

Two thrust bearings—placed close together—minimize the effect of the force applied on the tool by the hole. Thus, tools float freely into alignment—reducing down time and damage to cutting tools.

TROUBLE-FREE OPERATION

Balls are free to move in the required direction or rotate around the collet, because the floating element is separated from the drive. Free movement of the balls eliminates confined reciprocating motion. This greatly reduces the scrubbing action characteristic of small rocking movements. The scrubbing action often causes rapid destruction of ball-thrust plates and prevents free float.



How Parallel Float is Obtained

How Angular Float is Obtained

Write for Bulletin No. 8-50
showing complete range of sizes, specifications and prices.

Scully-Jones AND COMPANY

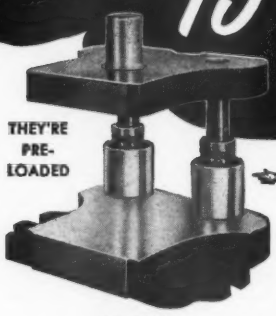
1913 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

R5607 RI P

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Save 15 Minutes OUT OF EVERY 60 IN DIE ASSEMBLY



specify

LEMPCO DIE SETS

Perfect alignment on every try

When you put dies mounted with Lempco Die Sets on a press you forget about maintenance. Such mishaps as frozen bushings, scored pins, pulled shanks or die damage just don't happen. More pieces per grind, less down time, close more accurately, produce pieces with cleaner edges and less scrap. For literature, write to Lempco Products, Inc. (Industrial Division), Bedford, O.

No pry bars, lead hammers or die pullers necessary!

Perfect alignment on every try

Forget

LUBRICATION TROUBLES

When you specify LEMPCO DIE SETS

LEMPCO

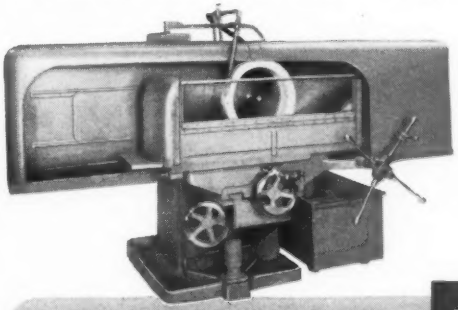
...Let's face it!

To set up a job on a production machine may take as much time as the actual production operation itself. Abrasive 18" Face Grinder can do many jobs single-handed which normally require two separate operations. Think how much this grinder can save you in time, trouble, expense!

Using an 18" wheel driven through an extra-heavy motorized spindle (15 H.P.), the Face Grinder gives you fast finishing of castings, dies, and other flat surfaces . . . eliminates set-up and production time on millers or planers . . . avoids costly transfer of stock from one machine to another.

Abrasive 18" Face Grinder is built to Abrasive's traditional high standard of quality — a rugged machine, designed for simplicity and ease of handling. All table movements are by hand feed. Special removable guards protect the operator from spray and mist, permit easy accessibility to the work, provide clear view of the work at all times.

Send for complete information and Circular F. Abrasive Machine Tool Company, 16 Dunellen Road, East Providence 14, Rhode Island.



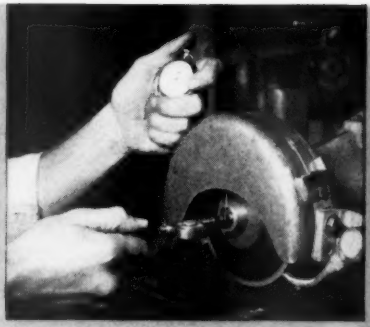
Abrasive Quality is Reflected in the Finish of Your Product

ABRASIVE

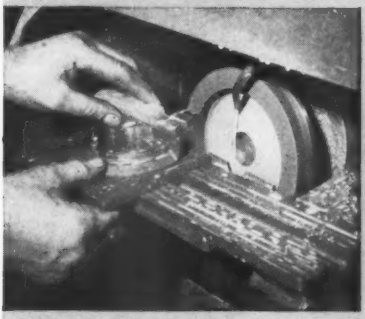
ACCURACY BOOSTS PRODUCTION

Tips on Diamond Wheel Operation THAT WILL Lengthen Wheel Life and Cut Carbide Grinding Costs

BE SURE SPINDLE AND BACK PLATE RUN TRUE. Before mounting a new wheel, check the spindle and back plate for possible runout. The backs of all Norton diamond cup wheels are precision ground to absolute parallelism with the cutting faces. So, if the spindle and back plate run true, the cutting face of your Norton mounted wheel will also run true.



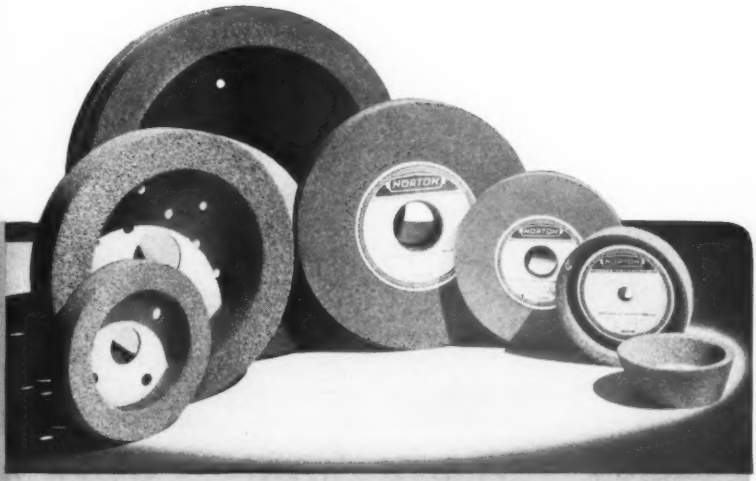
MAINTAIN CORRECT WHEEL SPEED. For best results, run resinoid and vitrified bonded wheels around 5000 surface feet per minute. At lower speeds they cut slower and wear faster. Metal bonded wheels can be operated at speeds as low as 3000 s.f.p.m.



GRIND WET WHEREVER POSSIBLE. Use a thin mixture of any standard water soluble grinding coolant. If stream is not available, use felt wick saturated with mixture of kerosene and light spindle oil or with a water soluble oil.

TRAIN YOUR OPERATORS. In the interests of better grinding practice, Norton maintains a large library of educational films in sound and color. It will pay you to show your own employees the films on carbide grinding and on the care of diamond wheels. They are loaned without charge.

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION



AND ...Investigate The New

K-Bond Crystolon* Wheels

Faster, freer cutting silicon carbide wheels with greatly increased uniformity in grinding action. This new vitrified K-Bond can be so accurately controlled that wheels of half-grade increments of hardness are possible — enabling you to "pin-point" specifications to your individual needs. Norton K-Bond CRYSTOLON wheels also reduce costs by widening the scope of silicon carbide abrasive. In many cases they permit using your more expensive diamond wheels for finishing, since they do numerous rough grinding jobs with entire satisfaction.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

TAKE ADVANTAGE OF NORTON KNOW-HOW

Your Norton Distributor has much to offer you besides Norton's top-quality products. He is also your contact point for a vast store of knowledge covering every detail of abrasives and grinding — available through Norton Abrasive Engineers located in every industrial center, and through the Norton staff of specialists in Worcester. See your Norton Distributor for the *right* wheels to use for your carbide grinding applications, and ask him for this free 140-page booklet on carbide grinding. Or write direct for FORM 167. NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities.

NORTON
ABRASIVES

Making better products to make other products better

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Announcing

America's Finest
HARIG Tools & Dies
Precision Craftsmanship

A new HARIG PLANT with modern precision equipment to SERVE YOU BETTER

HARIG makes America's finest

- CARBIDE DIES
- LAMINATION DIES
- PROGRESSIVE DIES
- BLANKING DIES
- DRAW DIES
- MOLDINGS DIES
- JIGS and FIXTURES
- PERFORATOR GRINDING ATTACHMENT
- SPECIALTY MACHINES

HARIG

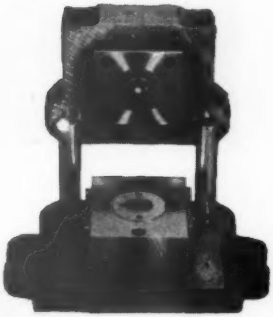
• MANUFACTURING CORPORATION
5761 West Howard Street, Chicago 31, I

"A MUST wherever WASHERS are made!"

HOVIS

OFFERS YOU THIS SIMPLE, UP-TO-THE-MINUTE METHOD

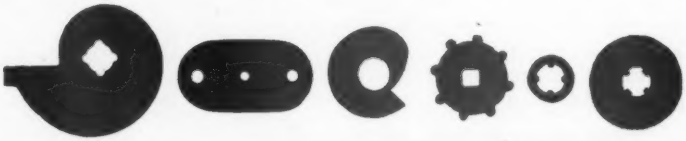
There's no need to make a complete new Die for any type washer or blank. The HOVIS UNIVERSAL WASHER DIES provide a Master Holder and by merely changing 5 SMALL, EASILY REMOVABLE PARTS the new washer or blank is produced . . . Special sets of parts are available for use in Master Washer Units enabling customers to produce irregularly shaped pieces and shallow draws. Multi-Washer Dies are also designed and manufactured.



Made in 5 sizes:

¾"—1½"—2½"—4"—6".

Write for literature.



HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD Phone: Slocum 7-1334

VAN DYKE, MICHIGAN Suburb of Detroit

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SAY "GOODBYE"

TO BIG PROBLEMS WITH SMALL PARTS

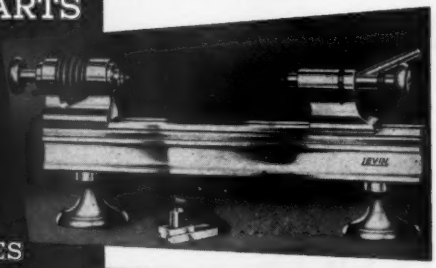
INVESTIGATE

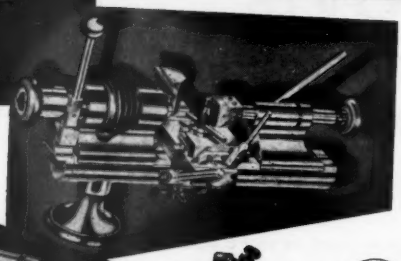
LEVIN®

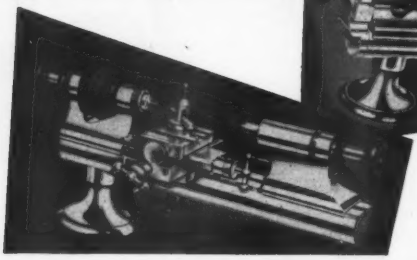
PRECISION JEWELER'S LATHES, ACCESSORIES AND MICRO-DRILL PRESSES

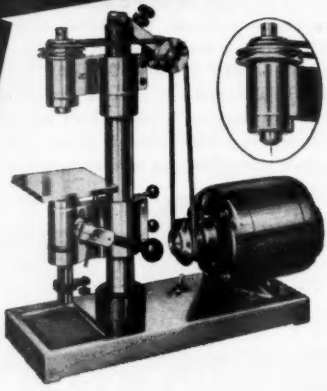
SEND FOR COMPLETE CATALOG

Ideal for second operations or experimental work on small instrument parts where sensitivity is required. Releases expensive, larger lathes for more suitable work. Full line of accessories available.





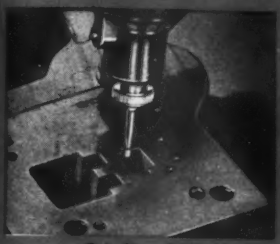




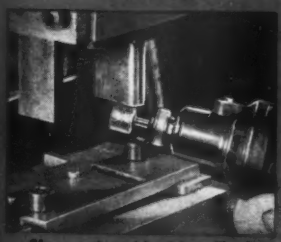
An extremely sensitive drill press for very small drills down to .002". Drills held in accurate collets to minimize deviation. Spindle run-out less than .0001". Finger tip control enables operator to feel progress of drill.

LOUIS LEVIN & SON, INC.
782 E. Pico Blvd., Los Angeles 21

Marking Parts



Grinding Dies



Sharpening Machine Tools

Burring Machine Parts

PAYS FOR ITSELF ON "HARD-TO-GET-AT" JOBS

DREMEL *Electric* MOTO-TOOL

APPROX. 27,000 R.P.M.

"THE POCKET-SIZE MACHINE SHOP"

Dremel Moto-Tools are time-tested—have been widely used in industry for over fifteen years. A veteran of World War II, Moto-Tool served in war plants and at military maintenance bases throughout the world. Thousands of these mighty midgets helped to make the atomic bomb—were used to establish production records in defense industries during the last war. Hundreds of toolroom and production line operations, such as polishing and grinding dies, burring parts, marking tools, sharpening cutters, touch up jobs, etc. are accomplished in seconds, **without tearing down "set-ups."** Moto-Tool is sturdily constructed for long lasting industrial service. Weighs only 13 oz.— dynamically balanced for vibrationless operation.

MOTO - TOOL KIT NO. 2 contains 23 accessories, including high-speed steel cutters and Model 2 Moto-Tool in natural finish hardwood case $23.50

MOTO-TOOL No. 2, with one emery wheel point $16.50

Dremel HIGH - SPEED STEEL CUTTERS and balanced wheel points are available for all makes of hand grinding tools.

Write For Industrial Catalog

DREMEL MFG. CO. Dept. 522-E **RACINE, WIS. U.S.A.**

JIG GRINDING ACCURACY *guaranteed**

INFINITE CONTROLLED SPEEDS 30,000 TO 65,000 R. P. M.

Easily connect jig grinder to jig borer or mill

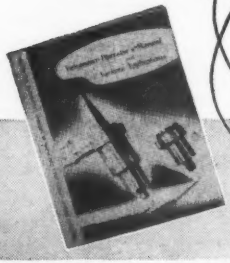
Then you can finish grind in hardened steel to "tenths" . . . jig grind dowel holes square with a ground base . . . move location of holes in hardened steel blocks . . . jig grind interchangeable holes in hardened sections . . . grind small holes with diamond impregnated mandrels . . . grind contours and relief with tungsten carbide burrs . . . grind radii in die sections . . . eliminate jig bushings in tools where close spacing is essential.

*Dependably accurate to "tenths"

Other infinitely controlled air driven spindle applications

Place spindle on most any machine. Use it for finishing contours on hardened steel working surfaces . . . burring or milling die castings . . . routing wood contours . . . carbide milling or finishing slots . . . finishing holes in hardened steel to "tenths" . . . grinding with diamond wheels, carbide burrs, or diamond impregnated mandrels.

Advantages—10 micro finishes using carbide mills . . . 8 micro finishes using mounted points, operates at any angle . . . air driven, air cooled, overheating prevented . . . speed controlled at optimum point . . . 3⅛" long motor uses little working space . . . By controlling speed at any point you abolish need for many constant speed spindles.



For immediate quotation please state machine tool application. Get this manual of photos showing operations Vulcanaire performs.

Vulcanaire

BUILT BY TOOLMAKERS FOR TOOLMAKERS

VULCAN TOOL CO., • PRITZ STREET • DAYTON 10, OHIO

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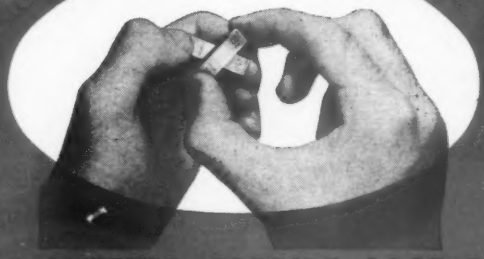
acclaimed
for permanent precision



FONDA LIFETIME-CARBIDE GAGE BLOCKS

With more than 100 times the wear of steel and highest corrosion resistance, Fonda Lifetime-Carbide Gage Blocks need never be replaced or recalibrated under normal usage. Acclaimed by leading manufacturers in the metal-working industry — and many others — who must have permanent precision. The unsurpassed excellence of Fonda Lifetime-Carbide Gage Blocks is further confirmed by the National Bureau of Standards.

FONDA "ULTRA-FINISH" STEEL GAGE BLOCKS — for applications requiring less wear and corrosion resistance — are made from a carefully selected grade of high-carbon tool steel which has properties for high hardness, dimensional stability, and wear resistance.

"ULTRA-FINISH" gives superior flatness and surface finish to all Fonda Gage Blocks. This exclusive machine-lapped finish makes possible effortless wringing and unbelievable adhesion. Wringing is done with the blocks clean and dry, eliminating surface films that produce errors.

Write for the new 1952 edition of our catalog: "Precision in Millionths."

82-piece set rectangular

FG

82-piece set square

FONDA

GAGE COMPANY, INC.

81 Daly Street, Stamford, Connecticut

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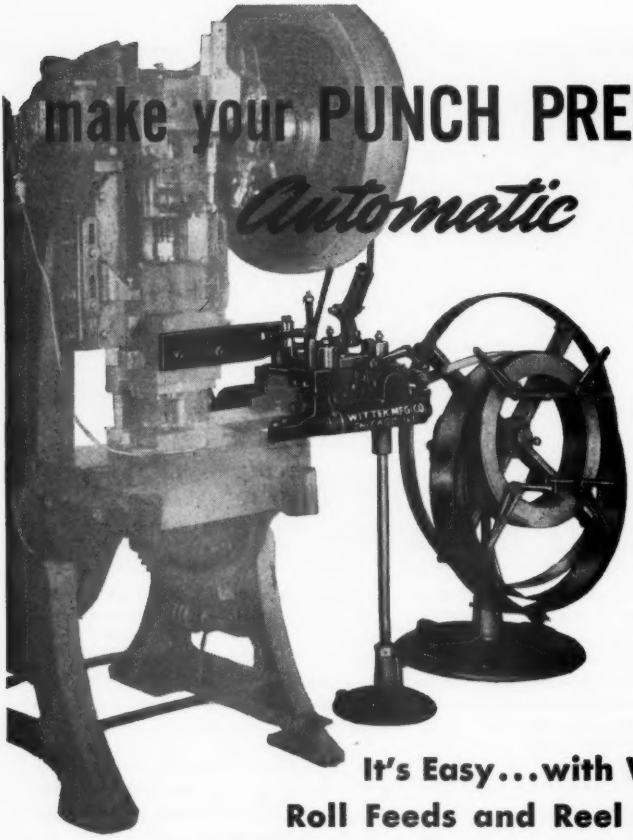
make your PUNCH PRESSES *Automatic*



It's Easy...with WITTEK Roll Feeds and Reel Stands

Wittek Roll Feeds handle any type of coiled strip stock and are made in single roll, double roll, and compound types with straighteners, in models to feed in any of four directions. They are reliable and accurate with simple, quick adjustment of feed length. Standard sizes and models meet a wide variety of press size and capacity conditions.

Wittek Reel Stands facilitate handling coiled stock.

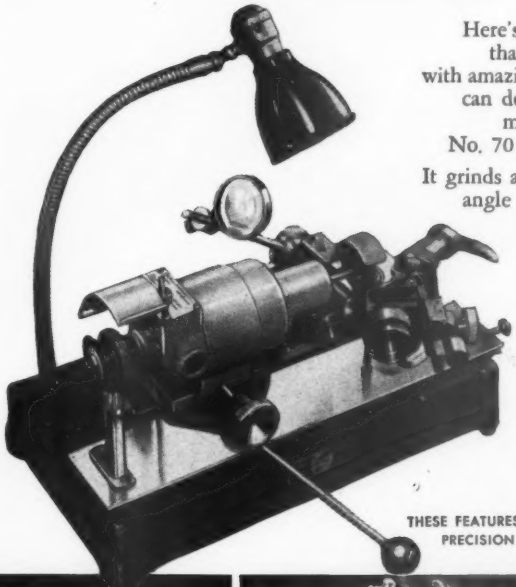
Write for full particulars

WITTEK Manufacturing Co.

4323 W. 24th Place, Chicago 23, Illinois

Automatic ROLL FEEDS AND REEL STANDS

This new DUMORE® grinder eliminates hand sharpening of small drills



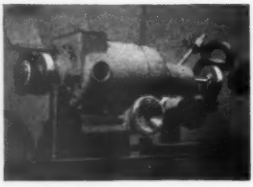
Here's a remarkable new grinder that sharpens small twist drills with amazing speed and precision. You can do away with expensive shop maintenance of 2-lip drills — No. 70 to ¼".

It grinds a drill point to any included angle from 90° to 150°, clearance angles 5° to 15°. Quickly sharpens and reclaims small-size, dull and broken drills. Dumore sharpened drills stay sharp longer, last longer. Get correct hole size, better hole finish every time. Hold scrap loses to a minimum.

THESE FEATURES MAKE THE DUMORE PRECISION GRINDER BETTER

EXCLUSIVE FEED-IN ATTACHMENT — Eliminates breakage and wheel gouging. Allows fine control of finish cuts. Speeds difficult sharpening, requiring extreme changes of point or clearance angle.

BROKEN DRILL RECLAIMER —Drills can be rough ground and reshaped on roughing wheel . . . then sharpened. (Grooved drill rest also serves as holder and locating fixture for diamond wheel dresser.)



ECONOMICAL WHEEL COST — Only uses wheel face. No expensive, shaped wheels. Individual wheels for web-thinning and roughing, eliminating frequent wheel dressing, assure longer wheel life.

Ask your nearby industrial distributor for a demonstration of this time- and money-saving Dumore Drill Grinder, or write

THE DUMORE COMPANY

1313 Seventeenth Street • Racine, Wisconsin

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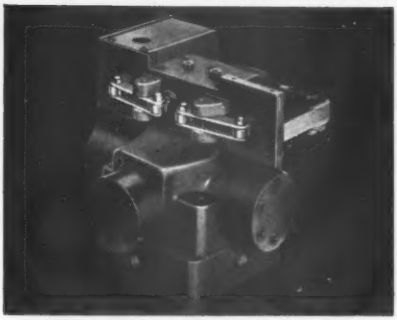
3000 psi., 4-way valve illustrating flush surface installation of UNBRAKO Cap Screws



UNBRAKO CAP SCREWS

PRECISION FINISH ADDS SALES APPEAL TO YOUR PRODUCT

Every spring, washer, nut and bolt is equally important to your product, but it's the finish that attracts attention, arouses interest, and creates a desire for it.

SPS makes its products to help you sell your products. Our threaded industrial fasteners—UNBRAKO Socket Screw Products—have the clean, precision finish to give your product added eye appeal; the uniform accuracy and strength to give it added sales appeal.

Take advantage of SPS Fastener Engineering. Let the experience and know-how of more than 40 years help you sell your product. STANDARD PRESSED STEEL Co., Jenkintown 36, Pennsylvania.

UNBRAKO SOCKET SCREW DIVISION

SPS
JENKINTOWN PENNSYLVANIA

CAP SCREWS • SET SCREWS • SHOULDER SCREWS • DOWEL PINS • PRESSURE PLUGS

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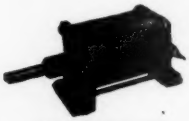
Cut Costs with

MEAD

AIR PRESS

PNEUMATIC WORK FEEDERS



AIR CYLINDERS

AIR VISES

Besides the standard, ready-made fixtures for the application of Air Power (such as the Air Press, Air Vise, Air Chuck, Air Clamp), Mead offers a wide selection of air cylinders, which can be used in special jigs and fixtures. Illustrations show four types of double-acting cylinders, which can be furnished in five different bores with optional length of stroke.

SINGLE ACTING AIR CYLINDERS

Use Mead Air Power

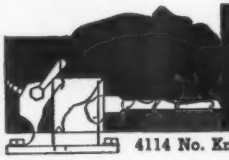
Get faster, more economical production set-ups—investigate the entire "family" of Mead Air-Operated devices. Hundreds of progressive factories now use them to do better, faster, more economical jobs. Do you want to move things—lift them, slide them, tilt them—or hold them firmly? Mead Air Power will do it. Do you need a delicate, flexible touch—or tremendous pressure? Mead Air Power has them both. If you are interested in saving time, money and man-power now and for the future, investigate Mead Air-Operated devices now.

**PNEUMATIC CYLINDERS*

MIDGET AIR CLAMPS*

• **Catalog Ready**

Send for copy of our new Air Power Catalog illustrating, describing many new man-and-money-saving devices.



MEAD SPECIALTIES COMPANY

4114 No. Knox Ave., Dept. HA-52, Chicago 41, Ill.

MICROBORE
by DeVLIEG

FOR PRECISION BORING

THE NEW MICROBORE MB-121 ADJUSTABLE BORING HEAD

This Boring Head is adjusted rapidly and accurately by means of proven micrometer Vernier arrangement. The tool slide can be adjusted in accurate increments from zero to ¼" off center. With a standard set of boring tools, bores ranging from ¼" to 1" diameter can be machined. The boring head can be furnished with straight, taper, or flanged type shanks to suit any make of boring machine.

Manufacturers Representatives: A few desirable territories are open to qualified representatives. If interested please write for details.

Send For Illustrated Catalog

DeVLIEG MICROBORE COMPANY
480 Fair Avenue • Ferndale 20, Michigan, U.S.A.

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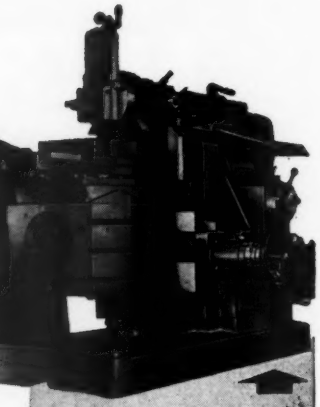
"TODAY...IT'S PRODUCTION THAT COUNTS"

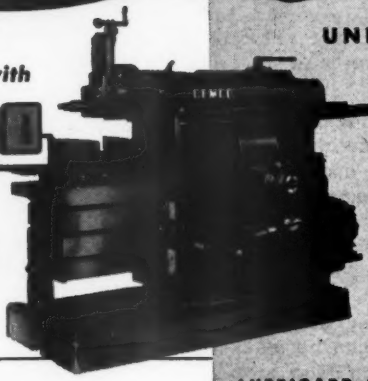


... BEAT COSTLY OBSOLESCENCE *with*

GEMCO

PRECISION SHAPERS

SAVE TIME...
SAVE LABOR...



UNIVERSAL TYPE

For tool and die work and general machine shop work requiring frequent changes and angular settings. Available in sizes from 16" to 36" stroke.

LUBRIGARD PROTECTED

PRODUCTION TYPE

For general machine shop use and heavy production work. Available in sizes from 16" to 36" stroke.

LUBRIGARD PROTECTED

• PLAIN TYPE SHAPERS
...available only in sizes 16" and 20" stroke

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4417 OLEATHA AVE
ST. LOUIS 18, MO
PRECISION MACHINERY SINCE 1907

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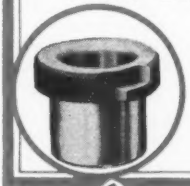

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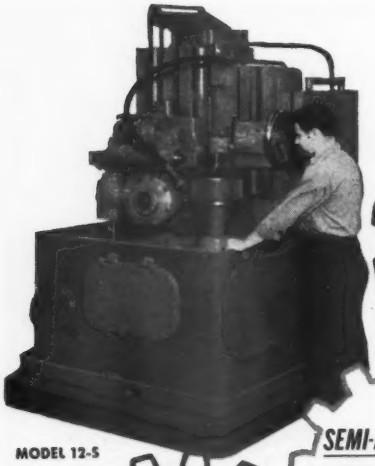

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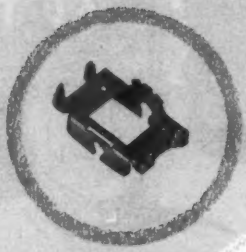

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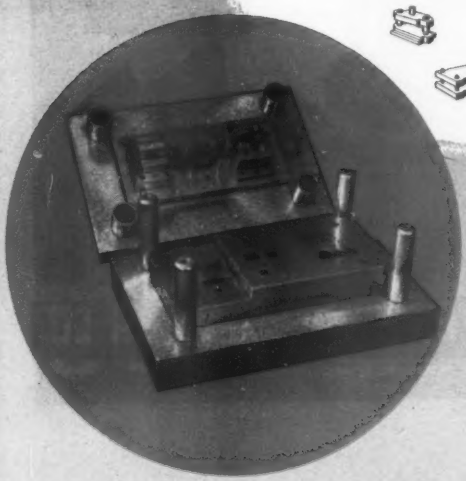

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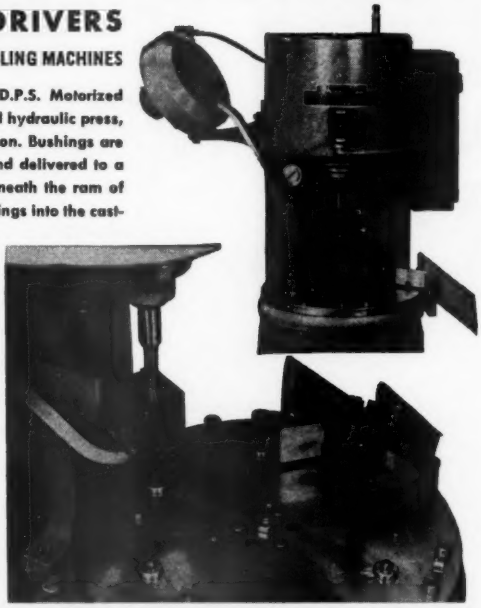

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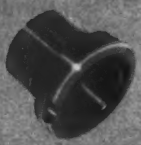

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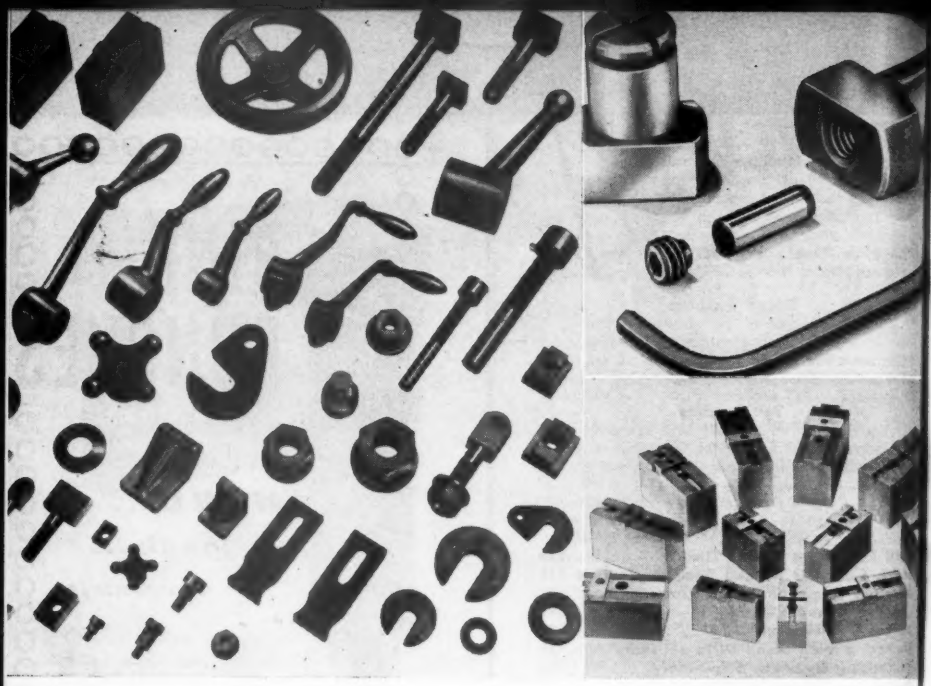

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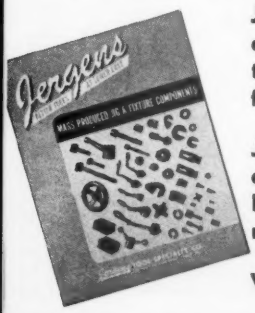

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next month's brew

is coming to a head very, very nicely. It certainly should, of course, if anything is to be gained by experience or if there's any truth in the old adage that "practice makes perfect." We are not claiming perfection, but we do feel pardonable pride in the many, high quality, editorial features which we will present to you next month.

We are referring to the fact that June 1952 will bring you our 6th Annual PRESS TOOLING & PRODUCTION Feature Issue. All the experience, sweat and tears, as well as pleasure and inspiration, that have gone into the building of its five predecessors will be evident in next month's "package" of authoritative and stimulating articles on press work, die designs and stampings. June's feature stories are "from industry and by industry"; written by men well-known as authorities in their respective fields.

If you're interested in development work and relatively few products for market sampling, three articles dealing with short run dies and methods will have the answers.

Or, if your headaches derive from the necessity of getting the highest production from a die, with the greatest output between grinds, the story of one of the largest and most complicated carbide dies ever built should demonstrate how you, too, can get 1½ million pairs of blanks per grind. This story is backed up by five production runs to date.

Are you up against such a fussy job as small 1½" blanks from .062" stock with two closely-held .072" diam holes? You might try the cradle die which will be disclosed next month.

You will agree that the blanking and forming of stainless steel is not quite as easy as shooting fish in a pail of water. Our June feature on fabricating the stainless steels will save you time, money and effort.

To return to the modest production rate department, an article on tooling the press brake for refrigerator cabinets will show what can be done with this very versatile machine.

Automobile body stampings have to be put out in a hurry and with a minimum of waiting time between press operations. The story on mechanizing a body stamping plant will give you ideas applicable outside of the auto industry.

All of the expensive skills and man-hours that go into a beautiful die can go up the flu from a heat treating mishap; which is why we're including a fine feature on the heat treating of die steels.

Another article that may help you cut costs and improve performance is on die design for metal blanking.

And there is still more, on presses, methods, die set designs, and press-working safety precautions.

We feel perfectly safe in promising that you will find many know-how and show-how dividends within the editorial confines of next month's 6th Annual PRESS TOOLING & PRODUCTION Feature Issue.

E. Willard Pennington

editor

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Screw Machine Tooling is one answer when "innumerable parts are machined into complex shapes". Here is a wealth of screw machine experience with the

Free Cutting Copper Base Alloys

by **Lester F. Spencer**
Chief Metallurgist
LANDERS FRARY & CLARK
New Britain, Conn.

The use of the free cutting brasses, bronzes or other copper base alloys within this category have proven to be of considerable importance to a fabricating industry such as Landers Frary and Clark where innumerable parts are machined into complex shapes. The use of these free cutting copper base alloys has, in many instances, increased production and lowered unit cost of standard items due to the permissible heavy feeds and high cutting speeds employed during machining. The extremely good machining properties of this class of material can be attributed to the addition of lead; this element ranging from 0.5 to 4.5 percent. In an investigation of the machining characteristics of yellow brass composition containing from 62 to 64 percent copper, Crampton [2] has diagrammatically indicated (consult Figure 1) that the ease of cutting improves rapidly with the first increase of lead content within the base composition and further increases are at a diminishing rate. Extrapolation of the curve as illustrated in Figure 1, has brought the conclusion that an increase of lead beyond 3.25 percent is of little advantage.

The addition of lead will increase the brittleness of the alloy composition which will permit the chip to break off readily in short curls rather than in long stringers. However, a prerequisite is that this insoluble lead addition be uniformily disseminated within the base structure so that the machining characteristics of a shipment be the same from bar to bar. In many instances, this uniformity in the distribution of lead has been found satisfactory; the only instances where we have found any difficulty in this respect is in leaded yellow brass hot press forgings. The importance of uniformity of the free machining addition cannot be stressed too frequently since it can disrupt a production schedule and also result in high tool costs; the latter occurring either as breakage or short life.

Although decreased tool pressures and increased brittleness within the alloy composition is noted with any lead addition, it has been stated [2] that extremely short brittle chips are obtainable only when at least 2.0 percent of lead is added to brass. It is also evident that in brass compositions that have other ranges within the copper content as well as within other copper base alloys [2], the addition of lead will definitely increase machinability, although the maximum lead content obtainable in the other type alloys may not be as high as 3.0 or 3.25 percent lead. The average precentages of lead that are found in most commercial base alloys are indicated in Table I; the variation of lead content as stated above being clearly indicated. The analysis given in this table is typical and are not to be used for minimum specification requirements.

As in most literature dealing with machinability of materials, Table I has a

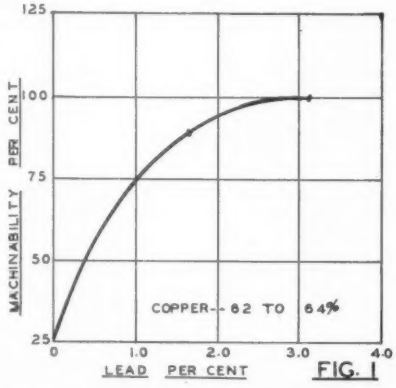

Fig. 1. The increase of machinability of yellow brass by the addition of lead (Crampton Ref. 2) also illustrated in Ref. 1.

column which reads 'Approximate Relative Machinability'; this material rating being used as a guide and serves adequately in indicating the ease of cutting the various copper base alloys. However, one must realize that a comparison like this may suffer in some individual cases since it is almost impossible to define machinability by any single designation. Thus, factors such as the ease of penetration of cutting tool, the character of the chip, the unit energy required for cutting; the smoothness of machined surface that is required, the tendency toward chattering at cuts and speeds designated in any individual case, the tool wear, the permissible speeds and feeds and the degree of heat generated on both work and tool components are but a few complications which arise in this estimation of machinability. It is needless to state that the lead bearing copper alloys have proven effective especially in such operations as deep drilling, box milling, tapping, forming, etc. Thus, where operations such as these stated have been performed, long stringy chips or even moderately curly but tough chips have caused excessive difficulty, scoring of work and tool breakage.

Unfortunately, free cutting brass, commonly known as yellow brass, cannot be chosen in all instances as the base raw material since other properties exhibited by the alloy is of equal or more importance than machinability. Thus, these other properties may be (1) hardness, strength and corrosion resistance; (2) capacity for

Table I

Name	Composition				Approximate Relative Suitability for Being Worked		Best Temperature For Hot Working Deg. F.	Approximate Relative Suitability for Being Welded				Approximate Relative Machinability Rating—Free-Cutting Type Brass = 100
	Cu	Zn	Pb	Misc.	Cold	Hot		Gas	Carbon Arc	Metal Arc	Resistance	
Free-Cutting Brass	62	34.75	3.25		Poor	Fair	1300-1450	Fair	Poor	Poor	Poor	100
Architectural Bronze	58	38.75	3.25		Poor	Excellent	1150-1350	Fair	Poor	Poor	Poor	90
Forging Brass	61	37.25	1.75		Poor	Excellent	1200-1500	Fair	Poor	Poor	Poor	80
Leaded Naval Brass	60	37.75	2	0.75Sn	Poor	Good	1200-1400	Fair	Fair	Poor	Poor	70
Medium-Leaded Brass	65	34.2	0.8		Good	Poor	——	Fair	Fair	Fair	Poor	70
High-Leaded Brass	61	34	2.0		Fair	Poor	——	Fair	Fair	Fair	Poor	90
High-Leaded Brass (Tube)	66	32.25	1.75		Fair	Poor	——	Fair	Fair	Fair	Poor	80
Low-Leaded Brass (Tube)	66.5	33	0.5		Excellent	Poor	——	Good	Fair	Fair	Fair	60
Leaded Commercial Bronze	89	9	2		Good	Poor	——	Fair	Fair	Fair	Poor	80
Tellurium Copper	99.5			0.5 Te	Good	Excellent	1400-1600	Fair	Fair	Fair	Poor	90
Telnic Bronze	98.3			1.0 Ni 0.2 P 0.5 Te	Good	Good	1400-1600	Fair	Fair	Fair	Poor	80
Leaded Phosphor Bronze	94		1	0.25P 4.75Sn	Fair	Poor	——	Poor	Poor	Fair	Poor	50
444 Bronze	88	4	4	4 Sn	Fair	Poor	——	Poor	Poor	Fair	Poor	100

being worked hot or cold; (3) electrical and thermal conductivity; and, (4) color. As an example, forging brass is the logical choice for a part which is to be forged and machined to size; in this case the alloy mentioned has better hot working properties than that exhibited by yellow brass. In regard to machinability characteristics, there is but a slight reduction; according to Table I, this being a relative reduction of 20 percent.

Both selenium and tellurium additions have proven to be valuable in imparting machinability to the copper base alloys; this addition being usually made on those copper alloys that have relatively high copper contents. On a weight basis [1], both tellurium and selenium additions are more than twice as effective as lead in improving machinability. The effect of these elements can be readily seen in the accompanying illustrations (Figure 2); this graph being the result of work conducted by Smith [3] in drilling tests.

An example of a tellurium addition is that of tellurium copper; this material being machined [5] about 25 percent faster than leaded copper or leaded commercial bronze and about 50 percent faster than leaded silicon bronze. The chips are fine and the tools, feeds and speeds that are employed in machining free-cutting brass can be employed in the machining of tellurium copper. As tellurium has not the reputed lubricating qualities of lead, the greater tool wear that has been experienced has often lead to the use of carbide tipped tools. One of the advantages of the tellurium addition is that the composition can be hot worked to a greater extent than experienced by the leaded copper alloys; in the latter case, it is often required to have a minimum lead content so that hot working operations such as forging and extrusions can be performed successfully. Tellurium copper is an ideal choice of machined parts which require comparatively high electrical or thermal conductivity. The addition of selenium to copper also results in a high conductivity, good machinable alloy very similar in properties and cutting characteristics than that exhibited by tellurium copper. In either case, the addition of the free machining element is approximately 0.5 or 0.6 percent.

In tests made by the Chase Brass & Copper Co. and reported by Crampton [2], the effect of tellurium additions to the 'alpha' copper base alloys on machinability is quite evident, however, the addition of this element on the 'alpha-beta' brasses are not favorable. Thus, when tellurium is added to muntz metal, an alloy of approximately 60 percent copper and 40 percent zinc, no improvement whatever results up to a total tellurium content [2] of approximately 1.80 percent, which was the highest amount used in these tests. The reason for this action is not quite understood, however it has been theorized that the copper telluride as formed in the alpha alloy may be a quite different dispersed phase within the 'alpha-beta' alloys. In other words, a complexity may have arisen which detracts from the machinability factor and thus cause poor results in machining of the 'alpha-beta' alloys.

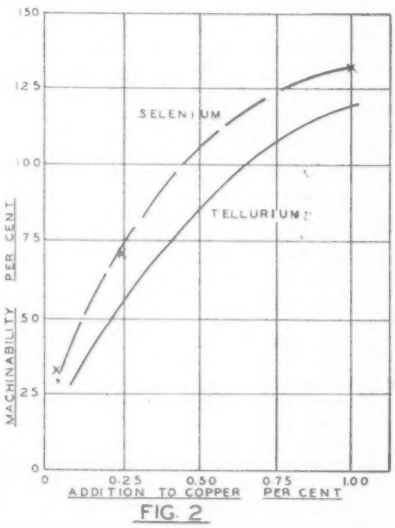

Fig. 2. The effect on drilling rates by the addition of Selenium and Tellurium to copper. (Smith, Ref. 3); also illustrated in Ref. 1.

Sulfur has been demonstrated as to have the same effect as lead in the machinability of the copper alloys, however no

(Continued on page 140)

Multiple Screw Machine Tooling and Methods*

Carbide forming and turning on automatic screw machines has not been a problem for some time. In the past, carbide tools on multiple-spindle automatics have not been entirely satisfactory, due to the relative inefficiency of drilling and threading operations. Therefore, carbides have only played a minor part when multiple tool setups are used, since feeds and speeds must necessarily be regulated to accommodate the slower operations involved.

by **C. R. Morgan**
Consulting Engineer
CONE AUTOMATIC MACHINE CO.

Today, however, the advanced efficiency and application of drilling and threading makes possible such an increase of feeds and speeds that all tools involved in the setups on automatics can perform to a more equal capacity. This capacity may be ten or twenty times the performance of present tooling and equipment, and with proper knowledge and utilization this may be exceeded.

To realize the full importance of present developments, and in order to take full advantage of carbide possibilities, an extended program of education is required to better understand those possibilities and, most important, the proper use and care of carbide tools, coupled with machine and machine tool requirements.

This program must involve not only the operator using the tools, but must include the setup men, tool grinders, supervisors, planners and methods engineers but, most important of all, those responsible for the purchasing of equipment and tools.

If proper equipment is not forthcoming we may as well forget the whole project and go back to antiquated methods. New higher performance can be obtained only by a thorough knowledge of equipment requirements and complete understanding of the care and servicing of carbides.

*From the 20th Annual meeting of the American Society of Tool Engineers. Presented here through courtesy of the Society. Ed.

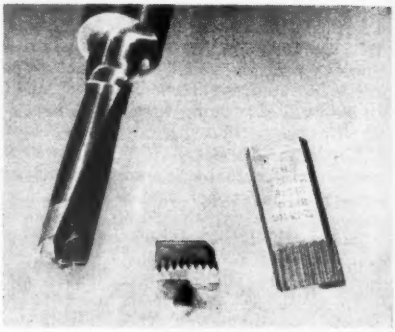

Photo courtesy General Electric Co.

Fig. 1. Carbide tipped drills and chasers now make it possible to take advantage of the efficiency of carbide forming and turning tools on automatic screw machines. Because speeds and feeds on automatics have to be regulated to accommodate the slower operations involved, full advantage of carbide forming and turning tools can not be realized with HSS. drills and chasers.

Can we afford to stand still when the known potential advantages are ten, twenty, or a hundred times greater than present performances?

Can we stand still when tool life can be increased from 50 pieces per grind to better than 20,000, and this on the regular and standard production and equipment available?

The program we have in mind is no minor project. It must include all of the following items, not necessarily as listed in order of importance, since each one is important in itself:

(1) Proper machine equipment; (2) Tool design; (3) Re-design of tool holders; (4) Improved tooling; die heads, box tools, etc.; (5) Accessories; (6) Speeds and feeds; (7) Lubricants; (8) Coolants; (9) Inspection; (10) Tool storage, and (11) Planning and layout.

Let us, briefly, consider each of the above items separately, so that we may realize, at least partially, what carbides

can do for us in relation to our specific needs, if properly applied.

(1) Proper Machine Equipment: Stability and rigidity in machine construction are a first consideration. Particular attention must be given tool slides, spindles, spindle bearings, increased speeds and feeds, greater motor power, chip clearance both in the tool area and in the machine base, coolant pumps, spindle seals, lubrication, and calibration of tool slides and holders.

(2) Tool Design: Improved tool design and methods must be employed to accommodate greater speeds and stock removal. Carbides do not function as did high-speed-steel tools; we must therefore change our practice in design and service. Where high-speed-steel forming tools were usually designed to complete a part to be made, it has become apparent that this practice is not satisfactory with carbides.

Where components have separate turns and shoulders are opposite, tooling should be so planned that two or more tools are used, so that clearances and angles can be maintained, enabling wear to be decreased and excessive grinding and tool waste eliminated. Tools of this type can be made at about one-third the cost of present design of tooling, and will outlast them at least five times in parts produced.

(3) Redesigning of Tool Holders: To obtain greater rigidity and more efficient holding, dovetail holders are being discarded and replaced by solidblock holders and tools.

With this construction, chatter and vibration can be eliminated; cost of holders and tools is automatically reduced and, as both are simplified, replacements are more easily obtained. These advantages automatically increase the operator's efficiency and reduce his maintenance and machine down time.

(4) Die Heads and Box or Turning Tool Holders: Simpler and more efficient tools of these types are now commercially obtainable. At present, carbide chasers outperform the die head operations. Some improvement has been made by relieving the vacuum or suction in self-opening die heads but sufficient progress had not yet been obtained. This condition should markedly improve when certain current developmental work is completed.

Turning and box tools can stand considerable improvement. One simple form of holder can be accurately set for any diameter in a very few minutes; will hold its size, and is simple and inexpensive.

(5) Machine Accessories: Let us compare previous performances to what is possible under ideal conditions.

When high-speed-steel tools were used to produce a given part, stock removal was around sixty or seventy surface feet per minute, and spindle speeds around

(Continued on page 90)

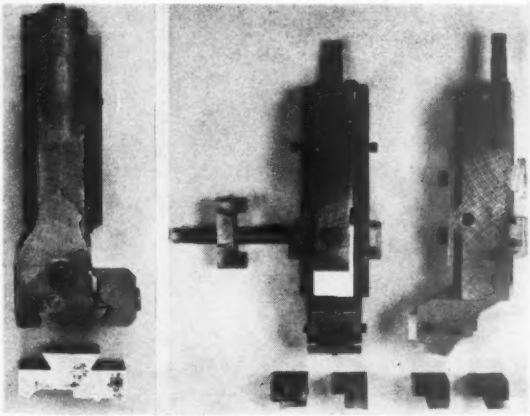

Fig. 2. The old type dovetail tool holders for automatic screw machines shown at the left, are gradually being replaced with those shown at the right. These are the new solid block type holders with which chatter and vibration can be eliminated. Their construction automatically reduces their cost and increases the operator's efficiency, thereby reducing his maintenance and machine down time.

Production Innovations Expedite Ford Axle Operations

New machines improve quality and special assembly equipment saves labor. Multiple nut runners extensively used. Topping of hypoid teeth a new departure. Vapor blasting improves tooth finish.

Several innovations instituted in the Axle Carrier Shop at the Mound Road Plant of the Ford Motor Company have not only expedited certain operations there but have resulted in improved quality of certain components.

Among the newer machines is that built by Modern Engineering Company to do "topping" or chamfering of the heel and toe (that is the outer edges) of hypoid ring gear teeth. This machine, Figure 1, uses inserted blades of high speed steel in a cutter of 6-in. dia. turning at 45 rpm. Cuts are 0.005 to 0.010 in. deep and result in a 45-deg chamfer. The cut is made on two teeth at a time and eight teeth per minute are topped.

Gears are hand loaded and clamped by hand in a fixture that turns slowly about its own axis and is also rocked so that generated cuts are made. Until recently, no machine for doing this job was available and, under some conditions, the unchamfered edges of teeth resulted in interferences and wear of gears in service, a trouble which is avoided by the chamfer.

Check of hypoid gears for runout and tooth irregularities are made at intervals on the Illinois Tool Company recorder shown in Figure 2, to make sure that each of the Gleason gear cutters in use are producing to specifications. Runout has to be held to a minimum. The machine produces a graphical record that shows both the runout and any tooth irregularities that may exist.

Tooth finish on hypoid ring gears and pinions is much improved by application of the Hydroblast treatment in Pangborn machines like that in Figure 3. A mixture of one part No. 100 grit to three

by **Herbert Chase**
Forest Hills, N. Y.

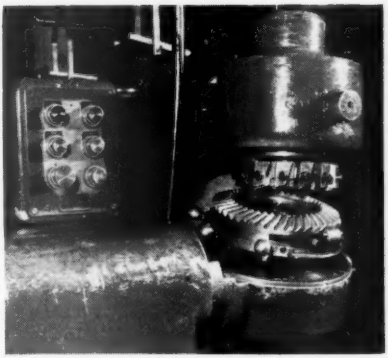

Fig. 1. Setup of a Ford ring gear in a new Modern Engineering Company machine that, in a series of generating cuts, chamfers the upper edges (from toe to heel) of teeth and thus reduces the chance of tooth tip interference in the final assembly.

Fig. 2. Using an Illinois Tool Company recording machine to check runout and tooth irregularities in a hypoid ring gear and pinion for Ford cars, this being to insure that gears are cut to specifications for minimum departure from concentricity.

parts of water is fed through four nozzels at each blast station on the rotating table. Gears and pinions are each done at the rate of 330 an hour. They are rotated slowly about their own axis as they are

Fig. 3. Finish on the tooth surfaces of rear axle gears for Ford cars is improved by subjecting them to Hydroblast in this Pangborn machine after the gears are heat-treated. This treatment also removes all scale and foreign matter.

Fig. 4. A Modern Engineering Company machine that chamfers the ends of splines on pinion shafts at a rapid rate, the workpiece being inclined in a fixture that indexes the shafts between cuts.

Fig. 5. Machine used in a Ford plant for induction annealing the threaded ends of rear axle pinion gear shafts after heat-treatment.

carried on a rotating table through the blast. This blast removes any oxide and scale left from the heat treating and also improves the machine finish. Differential side gears and pinions are similarly blasted but are done at twice the rate of that of hypoid gears and pinions.

Pinion shafts are splined and, after the spline is cut, are run through the Modern machine, Figure 4, to chamfer the end of each spline. In this operation, the tool is moved by a cam and chamfers the entire spline end contour, including the root diameter. Five teeth a second are chamfered, the shaft being indexed automatically between cuts. The fixture used is loaded and unloaded by hand and holds the shaft, of course, at the required angle while the cut is made. 300 shafts an hour are chamfered in this setup.

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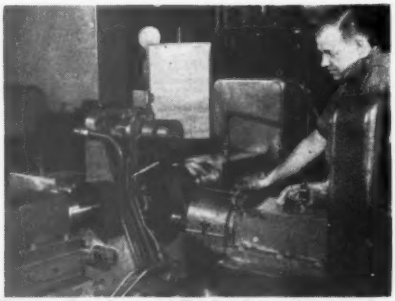


Fig. 6. Crossbores of Ford axle carriers are finished rapidly and precisely in this four-way Excello machine which makes all four cuts simultaneously in a single setting of the workpiece.

Advanced Screw Machine Tooling

The amount and different types of work which can be performed on automatic screw machines continually increases, due to various advances made in tooling, as well as to better machines. It is well to keep alive to all these advances as far as consistently possible, since one never knows when some particular improvement may apply to requirements in his own machining, and that to very high advantage. This is true of single spindle screw machines, both conventional and Swiss type, and

by **John E. Hyler**

is also true of multiple spindle machines.

Milling attachments applicable to turrets of standard single spindle machines have been doing some remarkable jobs of late, and have been responsible for elimination of various second operations. One interesting instance is shown in which a brass part, $\frac{5}{16}$" diameter, is milled with four slots, using two special milling attachments in turret stations 3 and 4 for the purpose. The setup includes an arrangement for stopping the spindle while the milling cuts are being made,

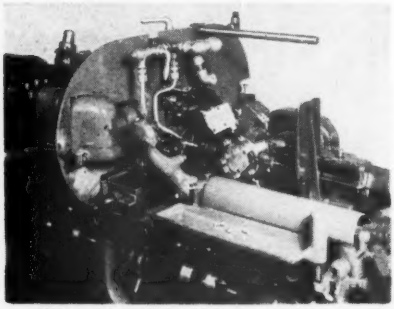
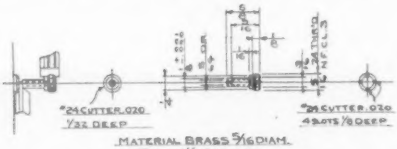


Photo courtesy Brown & Sharpe Manufacturing Co.

Fig. 1: Illustrating production of a brass part of 5/16" maximum diameter, in connection with which two special turret milling attachments are used for machining four slots.



MATERIAL BRASS 5/16 DIAM.
TIME 6½ SECONDS
GROSS PRODUCTION PER HOUR 553
*006 HIGH SPEED AUTOMATIC SCREW MACHINE
*50 SCREW SLOTTING ATTACHMENT MOTOR DRIVE
*50 LONGITUDINAL TURNING ATTACHMENT
ARRANGEMENT FOR STOPPING SPINDLE WITH CLUTCH BODY IN NEUTRAL POSITION

R.P.M. 1200	R.P.M. 6000	ORDER OF OPERATIONS & TOOLS	FEED
	20	CLEAR FORM BK. SL. TOOL (33 REV.)	.0015
	33	DRILL - 00AC FLOATING HOLDER	.0027 MIC.
	23	INDEX TURRET & REV. SPINDLE	
5	26	THREAD ON - 00H DIE HOLDER	
		REVERSE SPINDLE	
	6	THREAD OFF 00H " "	
	23	INDEX TURRET & STOP SPINDLE	
	68	MILL (2 SLOTS) SPEC TURRET MILLING ATT 2 00 REM. OCC	
	23	INDEX TURRET	
	68	MILL (2 SLOTS) " " " " "	.006
	23	INDEX TURRET & START SPINDLE	
	13	BURR INSIDE MILL SLOTS *00AC FLOAT HOLDER	.010
	23	INDEX TURRET	
	72	DRILL - 00AC FLOATING HOLDER	.0058
	112	TURN IN - LONGITUDINAL TURNING ATT.	.0011
		TURN AHEAD " " "	.002
	52	CUT OFF FR. SL. TOOL	.0013
	23	FEED STOCK TO SWING STOP	
	650	TOTAL REV'S	

Schedule courtesy Brown & Sharpe Manufacturing Co.

Fig. 2: Drawing and operation schedule for the brass parts shown being produced in Fig. 1.

with the clutch body in neutral position. The slots are cross milled, and spaced 90 degrees apart around the workpiece. A vertical slide attachment is also employed on this setup.

Another highly interesting application of a turret milling attachment has to do with machining three evenly-spaced radii along the turned body of a workpiece. In this case, the milling attachment uses three small end mills for the purpose. Use of a vertical slide attachment on this setup leaves both cross slides of the machine free for other operations required on this particular workpiece.

Excellent Die Heads Available

There are many cases in which employment of one of the excellent die heads on the market means much to the screw-machine operator producing threaded parts. Some newly designed

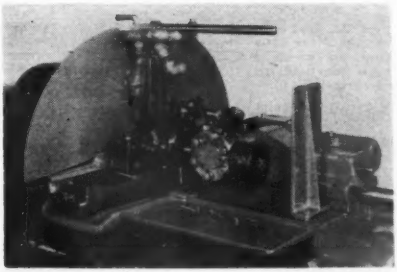
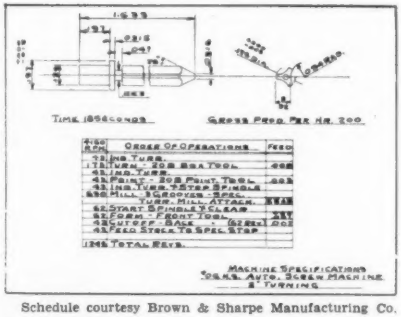


Photo courtesy Brown & Sharpe Manufacturing Co.

Fig. 3: This shows the production of a workpiece requiring three evenly spaced radii to be milled along the turned body of the piece. The job is accomplished in one operation by means of a turret milling attachment which uses three small end mills.

die heads for use with insert blades are quite versatile. One is designed in such manner that it can be used on a Brown & Sharpe automatic, on a Cleveland automatic, or on a hand screw machine, by changing a handle. A cushion is built into the die head, instead of into the shank, and an open hole is provided through the shank, which allows one to cut either long or short threads. The same firm provides efficient die heads which are particularly designed for use on Brown & Sharpe automatics.

Certain models of die heads are quite new, and are built particularly for use on Brown & Sharpe automatics and on small turret lathes. These dies are provided with chasers which are not only



Schedule courtesy Brown & Sharpe Manufacturing Co.

Fig. 4: Drawing and operation schedule for the workpieces shown being produced in Fig. 3.

easily and quickly removed and replaced in their holders, but which provide two edges. When one edge wears out, one simply turns the chasers over, whereupon he has the equivalent of a new set. Minimum down time and maximum production are natural results.

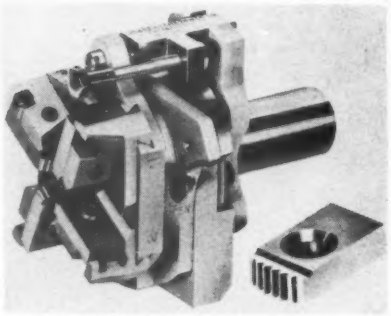


Photo courtesy Jones & Lamson Machine Company.

Fig. 5: Here are seen some excellent die heads, particularly suitable for use with Brown & Sharpe automatics and on small turret lathes. The one above is J & L's Model No. 16-S: capacity No. 0 to ⅜" NF. A ground thread insert type chaser with two cutting edges is shown. Below is shown the design of Models No. 18-S: capacity No. 4 to 9-1/16", and No. 19-S: capacity No. 4 to 1¼".

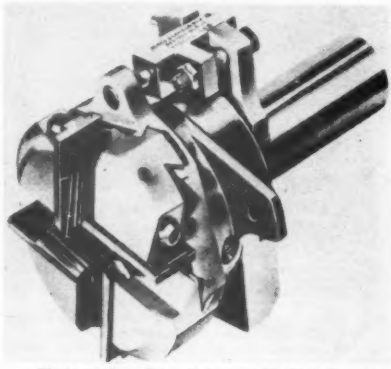


Photo courtesy Jones & Lamson Machine Company.

Many unusual screw machine jobs are now being performed to high advantage, and are saving a great deal of production time as against doing the same type of work in other ways. Different

(Continued on page 86)

. . . Ford Axle, from page 67

The spline ends of pinion shafts are threaded just before heat treatment. After heat treatment the shafts are placed in the Westinghouse induction heater, Figure 5, equipped with a four-place fixture to anneal the threaded-end. When the fixture is loaded by hand, the operator pres-

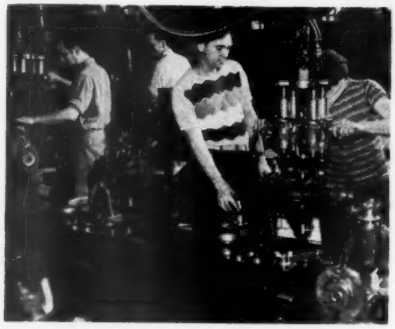
Fig. 7. Using a four-spindle air operated nut runner to tighten four cap bolts at one time on a carrier, as a preliminary to machining cross bores.

Fig. 8. Ten ring gear bolts are tightened, five at a time, with this five-spindle nut runner as the differential case is held on a conveyor fixture.

ses a button and the threaded ends are annealed automatically. Current shuts off after 18 sec. after which they are removed and hung on a chain conveyor that passes just above the heater. 400 shafts an hour pass through this machine.

Carrier cases require precise machining of two pin bores and two cross bores.

Fig. 9. Removing four cap bolts from an axle carrier after cross bores have been machined, so that an assembled differential case and cross-bore bearings can be placed and fastened in the carrier.



Rough boring is done first in two two-way Excellos but finish boring of all four holes is now done simultaneously in the four-way setup, Figure 6, also on an Excello machine. All four carbide boring tools feed in at once and remove 0.010 to 0.012 in. of metal on a side. Spindle carrying the tools turn at 1200 rpm.

With this new four-way machine, 82 work pieces are bored per hour and, with a hydraulic lockup in a single machine, the chance for errors is minimized.

Assembly of carriers is done on a track conveyor, parts of which can be seen in Figures 7 to 10 inclusive. One early operation is the assembly of four cap bolts and the tightening of these before bores

(Continued on page 200)

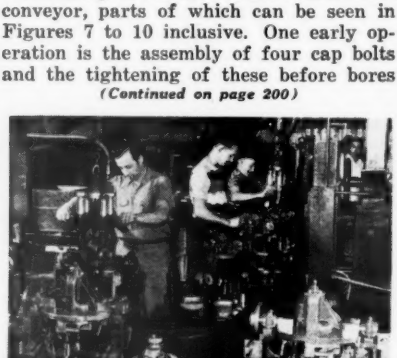


Fig. 10. After the differential assembly is in place, this four-spindle nut runner is used to tighten all four cap bolts at the same time.

A typical one-of-a-k… room job: milling the flut… a special h.s.s. drill. CINCINNATI No. 2MI Universal Miller.

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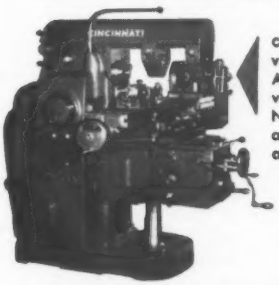

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The Machining of High Temperature Alloys*

by D. C. Goldberg
and
P. G. De Huff
Aviation Gas Turbine Division
WESTINGHOUSE ELECTRIC CORPORATION

Development of the gas turbine as a practical reality is partly due to the metallurgist's unceasing efforts to create alloys having always better mechanical properties. This is a continuing project which is recognized as an absolute necessity if the exacting demands of the jet engine are met. It has been only recently, however, that the engineers have appreciated what the development of such alloys means to the machine tool industry and the fabricator.

New tooling methods and machines are required to produce the jet engine parts if they are to be built in the volume needed. Machine tools must be designed to meet the demands of these tougher alloys, components of larger diameter and thinner wall sections, close tolerances, interchangeability, and higher production rates. This means increased horsepower, heavier beds, better bearings, variable speed drives, and automation in handling and contouring.

By reviewing the metallurgical and mechanical characteristics of these high temperature alloys, we hope to show you, the machine tool men, what is required to manufacture jet engine parts at increasingly heavier production schedules. We also hope to show that the metallurgist is aware of machine tool problems and is willing to cooperate in solving them.

In the machining of high temperature alloys, as with other steels, the optimum aim is long tool life, rapid removal of metal, low power input, and satisfactory surface finish. It is readily seen that in roughing operations the chief goal is to remove metal as rapidly as is economically possible, while in finishing the attainment of the desired microinch finish and accurate contour is required.

To achieve these goals, it is necessary to consider the following seven basic factors, variations in any one of which will have an immediate effect on the production rate and the quality of the completed part:

1. Inherent machinability of the alloy.
2. Design of the part being fabricated.
3. Design and type of the cutting tool.
4. Capacity and rigidity of the machine tool.
5. Accessory tooling.
6. Feeds and speeds.
7. Coolants.

Let us examine each of these basic factors:

Inherent Machinability of the alloy

Figure 1 shows the analysis of some of the alloys used in jet engines. These alloys are generally considered to be in the difficult-to-machine class. This is not strange when you find such elements as cobalt, chromium, molybdenum and titanium as major constitutents of the alloys.

NOMINAL CHEMICAL ANALYSIS OF HIGH TEMPERATURE ALLOYS

	Fe	C	Cr	Ni	Mo	Co	Al	Mn	Ti	Cb	W	O
Titanium 150A	1.5	.05 max	2.7	-	-	-	-	-	Bal	-	-	.30
Titanium 130B	-	.2 max	-	-	-	-	4	4	Bal	-	-	-
Titanium PD59466	1.7	.6 to .2	2.5	-	-	-	-	-	Bal	-	-	.06 W
AISI 347	Bal	.08	18	10	-	-	-	-	-	.8	-	-
AISI 410	Bal	.15	12	-	-	-	-	-	-	-	-	-
Inconel "X"	8	-	15	73	-	-	.7	-	2.5	1	-	-
Refractaloy 26	Bal	.06	18	37	3	20	.2	.7	2.6	-	-	-
Discaloy 24	Bal	.06	13	26	3	-	.1	.8	1.6	-	-	-
Timken 16-25-6	Bal	.15	16	25	6	-	-	-	-	-	-	Mg-.16

Fig. 1. Analysis of some jet engine alloys.

Those of you who are familiar with cutting tools will recognize that these same elements make up the high-speed cutting tools. An excellent example of this is the use of Stellite for rotating turbine

(Continued on page 74)

*A paper presented at the 16th Annual Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corporation, Pittsburgh, Pa., April 1 and 2, 1952.

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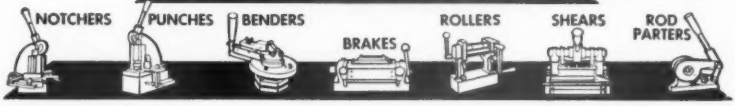

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Machinability, from page 72

blades. This material has long been used for a cutting-tool tip. Such parts are rarely machined to shape but are cast close to finish size and ground.

Figure 2 shows the parts application for these various alloys. The decision to make a part from a specific alloy depends upon meeting the stress requirements, corrosion resistance, and whether the material will be available for production quantities. From an examination of a typical jet engine, Figure 3, it is seen that as one proceeds from the compressor end to the turbine end, the alloy content of the parts increases.

As the alloy content of iron base materials goes up, the machinability index goes down. This is readily understandable when you consider that when the metallurgist adds specific elements to increase hot strength, he also increases the resistance to cutting shear. For example, the shear strengths in cutting for high temperature alloys are high—in the order of 135,000 psi—as compared to 109,000 psi for AISI 347.

Besides this factor of shear strength, other indices are useful in determining the inherent machinability of an alloy.

TYPICAL HIGH TEMPERATURE APPLICATIONS

MATERIAL	FORM	PARTS
Titanium	Forgings Bar Stock	Compressor Discs, Housings Bolts, Blades
AISI 410	Forgings Bars	Compressor Discs, Flanges Blades, Shafts
Discaloy	Forgings	Turbine Discs, Shafts Bases
Refractaloy	Precision Castings	Nozzle vanes, bolts
AISI 347	Bar Stock Sheet Casting	Bolts, Clamps, Flange Housings
Inconel "X"	Bar Stock Sheet	Blades, Bolts, Flanges Housings

Fig. 2. Applications of various alloys.

The coefficient of friction is significant as well as being easy to control since changes in coolants, feeds, speeds, tool design effect its magnitude immediately.

The plastic properties of the metal have an important effect on the machining constant. Variations in this index are controlled by varying thermal heat treatments. Recent work by various investigations has shown that this factor has a direct correlation to the shear angle of the chip formation. The larger the shear angle, the thinner the chip, and the better the machinability.

These three factors—shear strength, coefficient of friction and machining con-

(Continued on page 119)

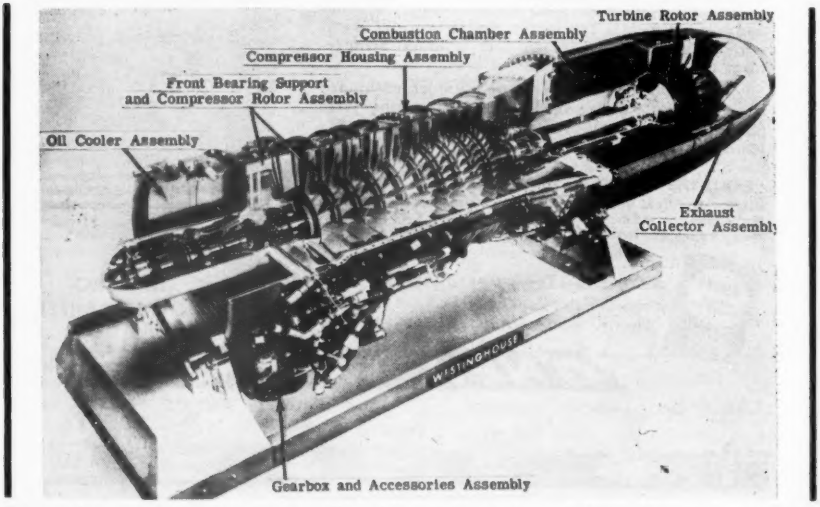

Fig. 3. Cutaway of J-34 jet engine. This shows many of the hard-to-machine parts which are detailed in the tables of Figures 1 and 2 and which are described in the text.

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Heat Treated Alloy Steel Tank Parts Machined on Carbide-Tooled Turret Lathe

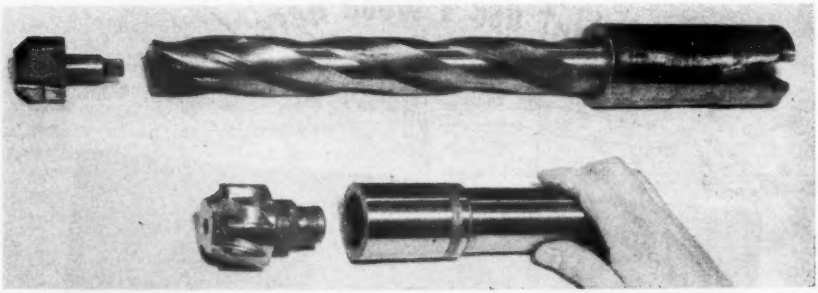

Fig. 2. The three-flute core drill and multiple point tool are both carbide tipped.

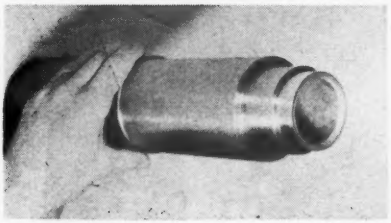

Fig. 1. The compensating idler arm spindle as completed on the turret lathe.

The extent to which carbide tooling can be applied on turret lathes to produce alloy steel parts is demonstrated by the machining operations performed on a tank component at the Detroit Arsenal.

This part, Figure 1, which is called compensating idler arm spindle is semi-finish machined from SAE 4340 steel tubing on a 3A Warner and Swasey turret lathe.

All tools on the machine are tipped with grade 78B Carboloy tungsten carbide, Figure 2.

The arsenal receives the stock for the spindle in the form of long tubing which is hack-sawed to length preparatory to the turret lathe operation.

As chucked in the machine, the tubing is about 16-in. long with an OD of $3\frac{5}{16}$ in. and an ID of $1\frac{1}{2}$ inches.

The first operation performed on the turret lathe is that of rough boring the hole about 2-in. deep with a turret-mounted standard carbide boring tool. This preliminary operation removes scale from the hole face and surface and promotes tool life of the carbide tipped 3-flute core drill that is next fed into the hole to a 14-in. depth, Figure 3. No further machining operations are performed on the hole. The work is turned at 174 rpm for the core drilling operation and the tool fed at 0.009 in. per revolution.

The spindle is then faced with a cross-head mounted standard carbide-tipped lathe tool. Following the facing operation, the part is removed from the machine and heat treated to 36 Rockwell C.

(Continued on page 78)

Fig. 3. Core drilling SAE 4340 steel tubing with a 3-flute carbide-tipped core drill on a 3A & S turret lathe at Detroit Arsenal.

by **E. R. Nickolai**
Foreman, Master Mechanics' Division
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. . . Detroit Arsenal, from page 76

After heat treatment the part is rechucked in the turret lathe and the outside diameters turned with standard carbide lathe tools tipped with Carboloy grade 78B. During the final OD turning operation, a turret-mounted carbide-tipped multiple point special tool is fed into the work, Figure 4, to machine a recess-type center.

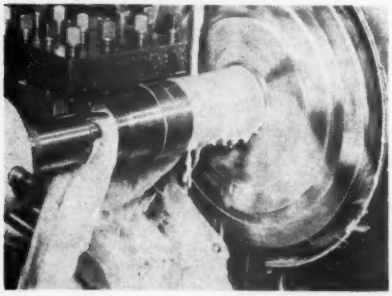
The part is then chucked in a second turret lathe and the other end is machined with carbide tools. Following the second turret lathe operation the part is mounted on centers in a Fay lathe and finish turned all over with carbide tools. Wherever possible, standard carbide tools are used on all three turning operations.

Maximum tool life is a major factor in Detroit Arsenal carbide tooling setup. The turret lathe department runs out production of various parts in quantities of several thousands. Then the machines are retooled for another part.

On the turret lathe operations, the carbide tools are sharpened on a regular schedule, and always before they are run to partial failure or total destruction. The Arsenal strives for maximum pieces per tool rather than only maximum pieces per grind.

The carbide-tipped core drill is sharpened after 20 pieces have been produced; the multiple point tool after 50 parts have been made. Boring and facing tools, which machine the scale and hardened surfaces are sharpened after 15 pieces have been produced.

Fig. 4. Centering the end of the heat-treated tubing with a special carbide-tipped multiple-point tool. At the same time the O.D. is being turned with a carbide-tipped lathe tool.



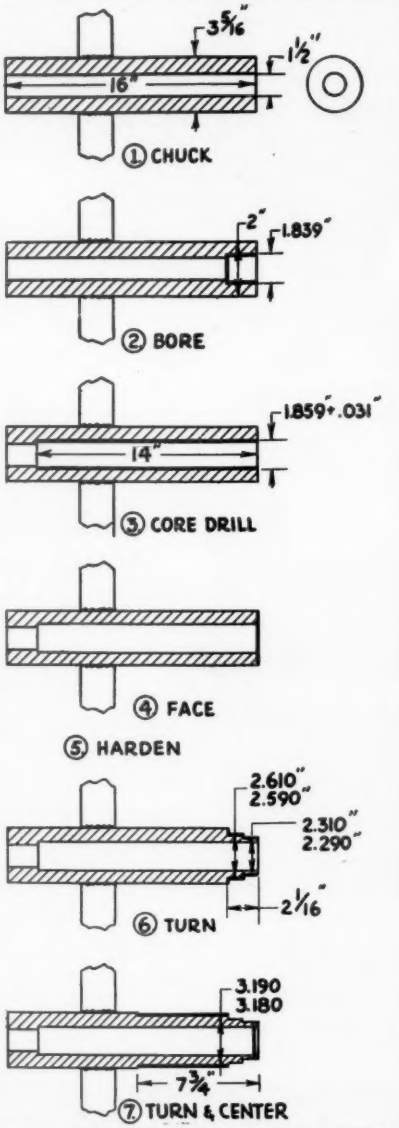


Fig. 5. Tool layout of the operations performed on the idler arm spindle.

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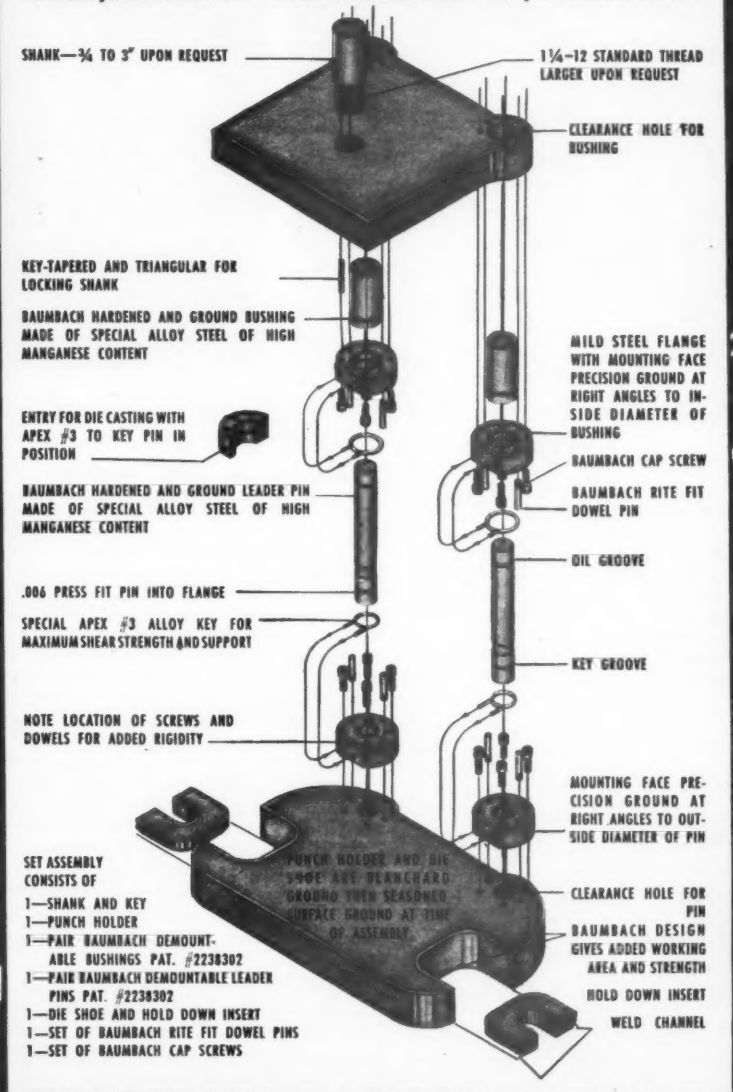
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ENTRY FOR DIE CASTING WITH APEX #3 TO KEY PIN IN POSITION
BAUMBACH CAP SCREW
BAUMBACH RITE FIT DOWEL PIN
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KEY GROOVE
NOTE LOCATION OF SCREWS AND DOWELS FOR ADDED RIGIDITY
MOUNTING FACE PRECISION GROUND AT RIGHT ANGLES TO OUTSIDE DIAMETER OF PIN
PUNCH HOLDER AND DIE SHOE ARE BLANCHARD GROUND THEN SEASONED SURFACE GROUND AT TIME OF ASSEMBLY
CLEARANCE HOLE FOR PIN
BAUMBACH DESIGN GIVES ADDED WORKING AREA AND STRENGTH
HOLD DOWN INSERT
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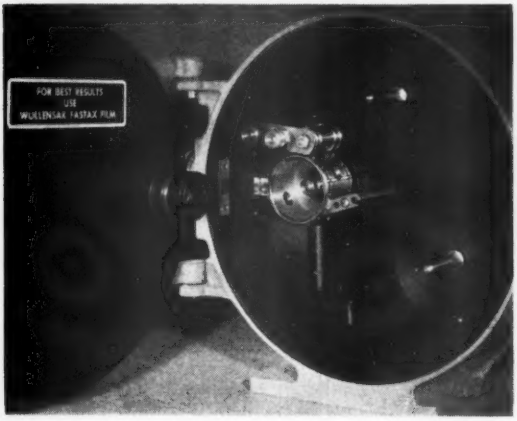
Fig. 1. (left) Internal view of camera showing easy acess to sprocket and light path for focussing. **Fig. 3.** (right) Film strip of exposures made at a rate of 5,000 per sec.



New Fastax Camera Combines High Speed and Oscillographic Photographic Motion Analysis

The simultaneous recording of mechanical and electrical phenomena has always presented a serious problem from the analytical standpoint. Also, the absolute time of occurrence of an event such as a detonation or an explosion has presented serious problems.

To overcome these situations, the Fastax combined oscillographic and high-speed motion picture camera has been developed. Figure 1 shows the internal view of the camera. The lens which is used to photograph the high-speed motion picture is shown on the front of the camera. Any of the lenses in the standard Fastax Raptar series are interchangeable with the 2" f2 Fastax Raptar furnished with the camera. The field of the high-speed picture is checked by placing focussing film on the sprocket and viewing the image with a dental mirror through a hole in the sprocket. The lens on the door of the camera is a 35mm f2 focussing Raptar, and with such a scale that close-ups of a cathode ray oscilloscope can be recorded or with the use of a mirror arrangement, detonations or flash events. Figure 2 shows a typical mirror arrangement for use on the side of the camera, where the cathode ray oscilloscope is mounted to the rear.

Fig. 2. Side-mounted mirror for directing oscilloscope pattern to the film.

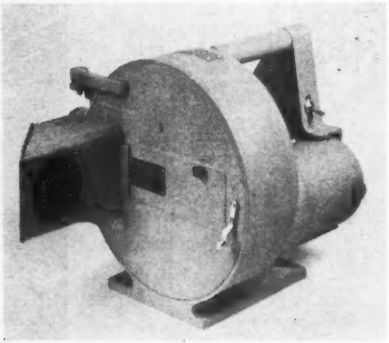
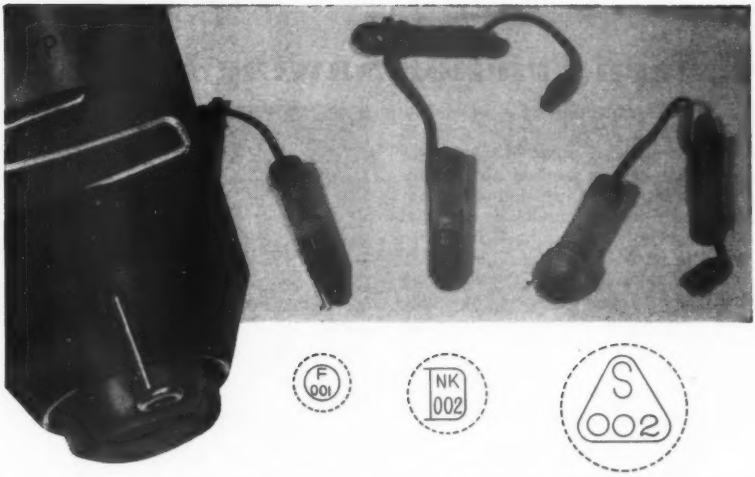


Figure 3 illustrates the firing of an Edgerton gas discharge lamp. The left-hand side shows the high-speed motion picture of the flash, and, on the right-hand

(Continued on page 200)



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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Modern Friction Sawing Practice

The recent introduction of a band saw blade specifically designed for friction sawing has created a great deal of additional interest in this method already industrially accepted as phenominal, that is, insofar as its 1" practical material thickness is concerned but particularly so as applied to work sections ½" and under. Heretofore, blades used for friction sawing lacked the prime essential of adequate flexation which in turn unfortunately shortened tool life considerably.

by **H. J. Chamberland**
Research Engineer
THE DO ALL COMPANY
Des Plaines, Illinois

Fig. 1 Friction sawing 1/16" stainless steel casket parts with an average cutting rate of 800 lineal inches per minute.

By means of a unique heat treating process the teeth of the new friction saw band are permanently anchored and locked in place. The result is uninterrupted production for a long period due to maximum flexation as provided by the metallurgical characteristics of the band. Therefore, it is now possible not only to increase former straight cutting rates with the 1"

Fig. 2 Countour friction sawing 3/32" stainless steel frames, thus eliminating costly trimming dies. Former low speed sawing production has been increased 400%.

blade, but the ¾" and ½" widths will prove relatively more effective when sawing curves of dimensions based on band width and material thickness.

Materials Within the Scope of the Process

Most steel alloys are within the low melting point and therefore lend themselves to cutting by friction. Rockwell hardness is not a determining factor

(Continued on page 84)

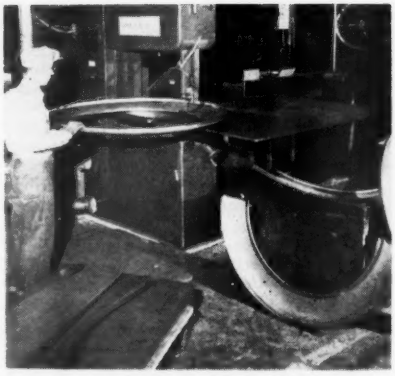

Fig. 3 Slitting 3/16" hard steel discs, cutting time per piece representing 6 lineal inches is .35 minutes.

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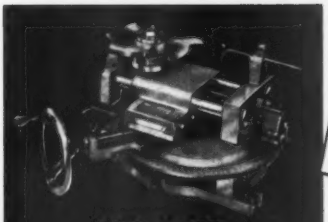

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Friction Sawing, from page 82

Fig. 4 Special automatic table feed set-up for friction sawing 5/16" alloy steel chain saw guide bars to a radius has increased production 300% and improved quality of cut.

since hardened steels and welded sections are excellent applications. The time for cutting such tough metals as armor plate and stainless steels is reduced from hours to minutes. High melting point materials such as Calite and tungsten carbide cannot be friction cut. Materials which fall into an extremely low melting point range are not within the friction sawing category; a few types of plastics having abrasive bases do, however, respond very well to a combination of actual friction sawing and high speed sawing. Saw life may be one, two or three days, depending on the nature of cut and dexterity of operator.

For cutting ferrous sections up to ½" the friction sawing process has not even a close competitive method; furthermore, cutting rates of 13 lineal inches per minute on ¾" armor plate and 16 lineal inches per minute on ⅞" stainless are current production possibilities but a 1" material thickness should definitely be regarded as a practical and economical maximum. The thinner the work section presented to the saw, the faster the cutting action; therefore, 1/16" stainless steel sheets can be cut as fast as they can be

Fig. 6 Highly abrasive plastics, particularly the glass impregnated types, may be cut through a combination of actual and friction sawing when production rather than tool life is the prime objective. Otherwise, conventional sawing should be given the preference.

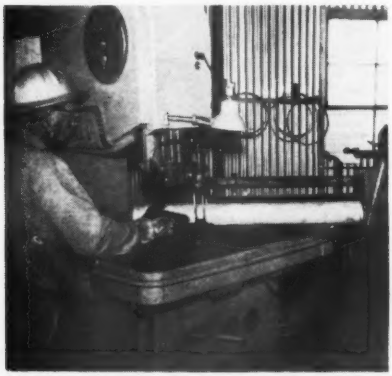

Fig. 5 Angular friction sawing 4" O.D.x3-13/16" I. D. seamless steel tubing, using work-holding fixture. Production is 16 cuts per minute, actual cutting time.

pushed through the saw or at approximately 1200 lineal inches per minute. Rocking the thicker sections automatically presents a minimum thickness to the saw, this is accomplished by first raising the material so only the top edge contacts the teeth, then lowering the piece to the table and alternately raising and lowering with no interruption all through the cutting process. It is advisable to use this procedure for a thickness over ¾" but technicians should be consulted before attempting to cut any thickness exceeding 1".

(Continued on page 120)

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. . . Screw Machine, from page 69

types of shafts are machined with helical oil grooves on multiple spindle screw machines, as a case in point. In some instances, helical oil grooves are rolled into shafts at the screw machine, using a suitable attachment. In other cases, such grooves are cut by means of a single point tool, held in a collapsible threading die head of standard type.

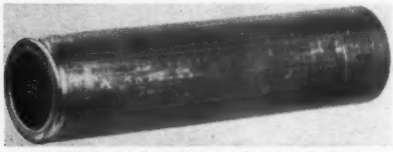


Photo courtesy Greenlee Brothers & Company.

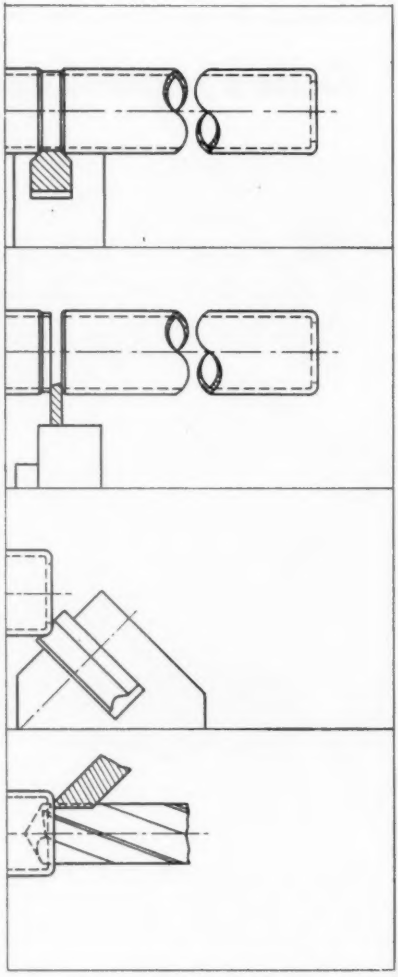
Fig. 6: Illustration of a tubular part, the left-hand end of which has been crimped in the automatic screw machine by a special crimp roll. The crimp roll and its holder are seen in another illustration.

Cross Drilling at Screw Machine

Cross-drilling operations are performed in many instances, sometimes using special cross-drilling attachments designed to revolve at work speed, at the same time a drill is advanced which turns on its own axis. The many types of auxiliary screw machine attachments to which workpieces are advanced by a transfer arm after being cut off in the screw machine proper, are fairly well known. In some cases, bushings and other bored parts produced on multiple-spindle automatics are subjected to induction hardening at one of the stations shortly before being cut off, and special quench arbors are used in this connection.

New aspects of tooling are being initiated in different places, some of which have to do with development of new attachments, and others with interesting applications of carbides. Advanced types of gauges for checking screw machine parts are extremely helpful in arriving at accurate setups with dispatch. Threads are rolled to good advantage on screw machines in different cases. A thread-rolling operation is in practically every case preceded by a shaving operation at a prior station.

Eccentric drilling and other eccentric machining, cross milling or straddle milling, and various other interesting jobs



Layout courtesy Greenlee Brothers & Company.

Fig. 7: Showing the tooling layout for the tubular part with the crimped end as seen in Fig. 6. Note how portion of moderate thickness is left standing when one part is cut off, and note how the crimping roll turns this thinner portion inward.

may be performed through use of either standard or special attachments developed by screw machine manufacturers. Obviously, since eccentric drilling can be

(Continued on page 88)

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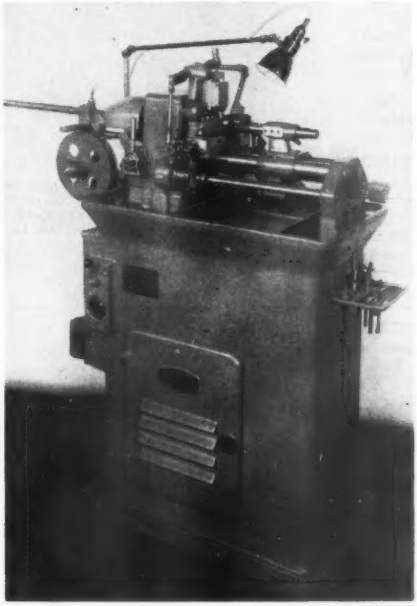

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Max. Threading Length	1½"	1⅝"	1⅝"	
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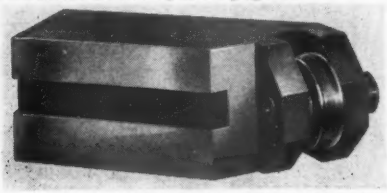


Photo courtesy Greenlee Brothers & Company.

Fig. 8: This illustration shows the special crimping roll and its holder, as used for the tube crimping operation shown in previous illustrations.

done from the tool slide of multiple-spindle automatics, eccentric hollow milling also can and is performed in some cases. It is actually possible to generate squares, hexagons, etc., on material being processed through automatic screw machines, though design of tools required for this purpose is considerably more involved than that of special attachments usually found in operation.

Tube Cutting and Crimping

One interesting job performed on a highly-competent multiple-spindle ma-

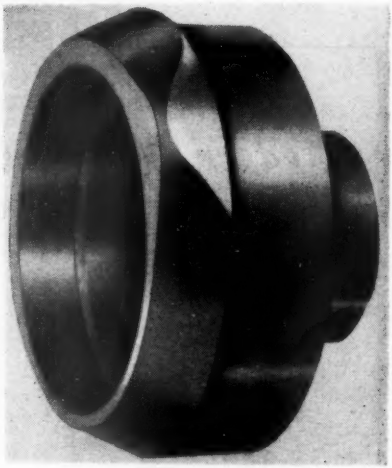
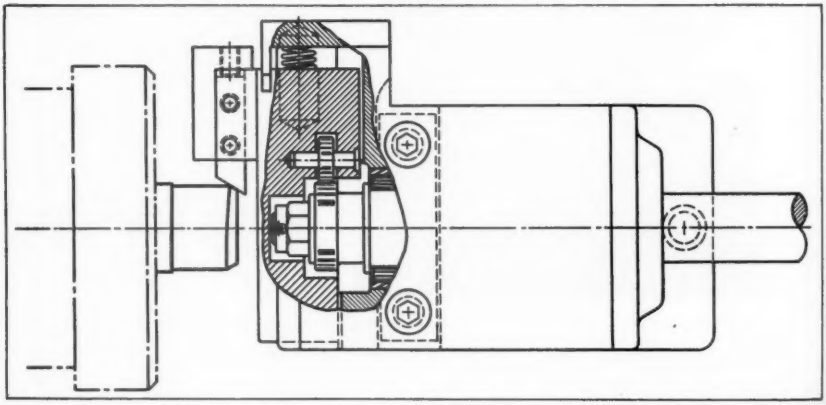


Photo courtesy Greenlee Brothers & Company.

Fig. 9: Illustration of a special part on which an irregular contour has been turned on the automatic screw machine. Attachment used for generating this irregular surface is seen in Fig. 10.

(Continued on page 92)



Drawing courtesy Greenlee Brothers & Company.

Fig. 10: Showing the attachment used for generating an irregular contour on the parts shown in Fig. 9. Note the main housing bracket contains an operating cam shaft. At the point where the housing bracket is shown broken away, the cam can be seen, together with its follower roll. The auxiliary bracket mounted on the front of the camshaft housing slides up and down on gibbed ways, as actuated by the cam, against the resistance of the compression spring shown. Thus, the cutting tool carried by the bracket copies the cam contour onto the workpiece, due to the fact that the cam revolves at work speed.

This reamer averaged

The hole in the base of a projectile must be reamed to extremely close tolerances, both as to size and finish. Not every reamer can give you good results in these 1040 steel forgings without frequent regrinding. ◈ In tests on the set-up illustrated above, no other reamer equalled the performance of *Cleveland* High Speed Adjustable Reamers! These superior tools consistently averaged *1,800 holes per grind* without sacrificing accuracy or the requirement for a smooth finish of the hole. ◈ You too can get MORE HOLES PER GRIND with *Cleveland* Reamers. One of our Service Representatives will be glad to make arrangements for a test in your shop. Contact the nearest Stockroom, or . . .

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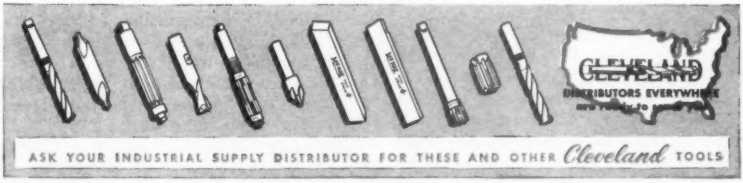


ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Tooling & Methods, from page 65
three to four hundred revolutions per minute.

This was considered normal because drilling and threading, the usually limiting operations, were not as efficient in stock removal as were forming, turning, shaving, or other operations in removing external material.

However, when drilling and threading were raised to the efficiency of other operations, or in some cases exceeded their performance, spindle speeds and stock removal were increased from six to ten times that for high-speed-steel tools.

Therefore, the part that had been produced in ninety seconds could be and is now produced in fifteen seconds; it could be made in ten to twelve seconds if some conditions could be overcome that are holding us down. Die head operations were the critical factor in this case. This die head has to operate six times every minute, therefore, we should not criticize this tool too severely. We only are requesting some improvements to better its performance.

The fact that the piece in question required more than seventy percent of drilling and threading time, compared to about thirty percent turning and forming time, is evidence of the value of the drill and chasers and their part played in the time cycle reduction.

It is axiomatic that, as greater spindle speeds are required, increased motor power is necessary.

Again, if a tool efficiency program is to be carried out, we must consider the operator's servicing and its effects on how much can be done to relieve him for more essential work or for servicing a greater number of machines without increased effort.

Since, in the case cited, we have decreased the cycle time to one-sixth of former practice, the figures show something like the following:

In ninety seconds the operator could have produced about 40 pieces per hour gross, or 430 per eight-hour day. This would require lifting about 960 pounds of material per day. Running three machines per group, this would mean a total of 2,800 pounds.

His cycle time now is fifteen seconds,

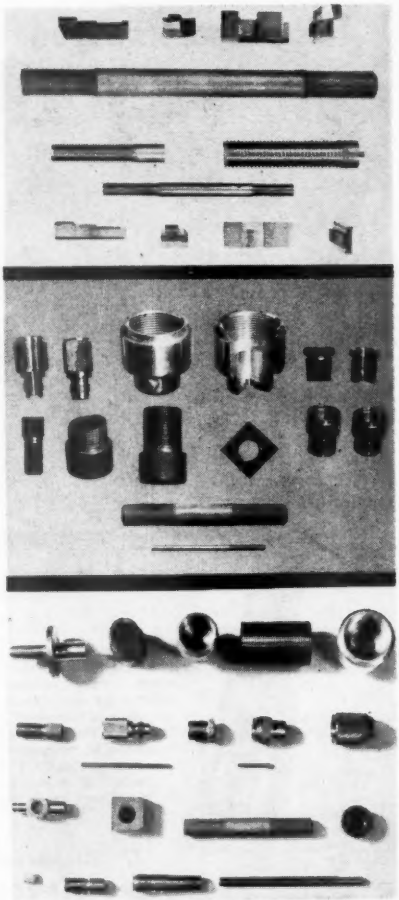


Photo courtesy General Electric Co.

Fig. 3. A three panel photograph showing samples of work pieces produced on automatic screw machines, tooled with carbide drills, carbide chasers, and carbide forming tools.

therefore his gross could be 240 pieces per hour or 1,920 pieces per day. On three machines, this would make a total of 5,760 pieces per eight-hour day, making a total weight of some 17,000 pounds to be lifted per eight-hour day.

This, of course, is ridiculous. However, it shows the necessity of correcting each

(Continued on page 98)

ADAPTABILITY TO MEET MANY DEFENSE REQUIREMENTS

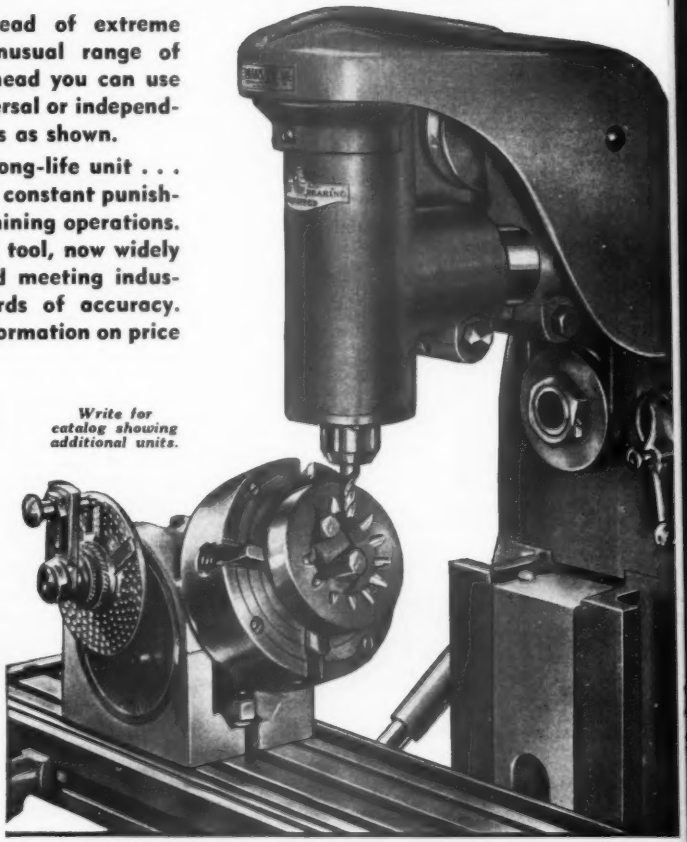
The MARVIN DIVIDING HEAD

A small dividing head of extreme accuracy and an unusual range of division. With this head you can use drawing collets, universal or independent chucks, or centers as shown.

It is rugged, tough, long-life unit . . . fashioned to take the constant punishment of normal machining operations. It is a high precision tool, now widely used in industry, and meeting industry's highest standards of accuracy. Write now for full information on price and range uses.

Illustrated at the right is the Marvin Dividing Head in operation with the new Marvin Vertical Mill-attachment for bench millers.

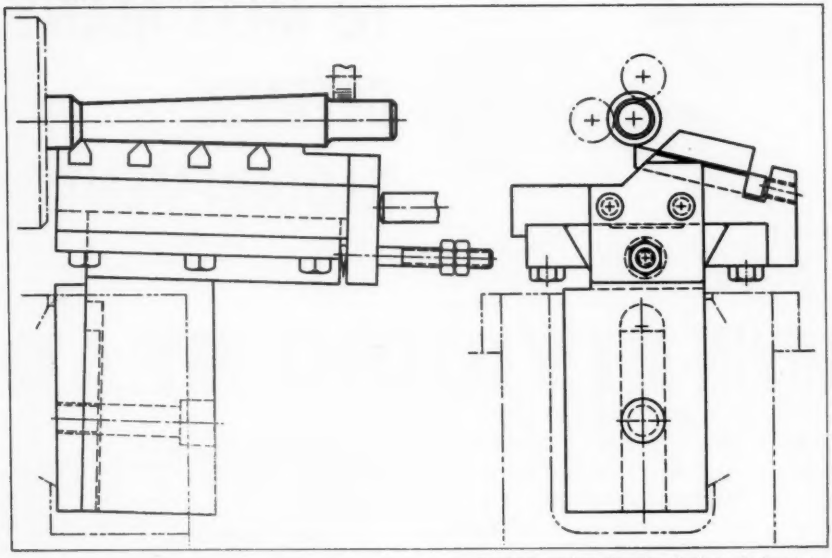
Write for catalog showing additional units.



MARVIN MACHINE RODUCTS, INC.

414 FORD BUILDING ETROIT 26, MICH.

. . . Screw Machine, from page 88



Drawing courtesy Greenlee Brothers & Company.

Fig. 11: Top and end view of taper turning tool developed for use on multiple spindle automatic screw machine, which greatly steps up production on long tapers to be produced. Use of a tool of this type eliminates wide form tools, which are expensive to purchase and sharpen.

chine has to do with a tube cutting and crimping operation. The tubular parts produced are for use as spring containers, and the crimped over portion at one end serves as a spring seat. The outstanding feature of the setup is a special crimping roll and holder. The cutoff operation is shifted, so the pieces may be severed in the second position. A reduced-thickness portion of the metal is left standing on the forward end of the piece to follow. The actual crimping operation is then completed on the following piece while only a small portion of stock is projecting from the work spindle. This minimizes distortion and springing of the tubular material.

Fig. 12: Illustration of eccentric stud machined to advantage on multiple spindle automatic screw machine.

Photo courtesy Greenlee Brothers & Company.

One of the most unusual jobs recently performed on an automatic screw machine is that of generating an irregular contour on the outside diameter of a revolving workpiece. This has been done to high advantage on one of the highly-competent multiple-spindle machines found in use in many places. A drawing of this operation is shown, together with a photograph of the actual part on which the irregular contour is machined. The operation is not that of making an eccentric cut merely, but the attachment shown actually generates an irregular surface on the work during the machining cycle. The irregular surface or contour is regulated by means of a master cam incorporated within the attachment body. By altering the form of the cam,

(Continued on page 96)

Precision machining of **PRODUCTO**

DIE SET

maintains close tolerance production for **OTIS ELEVATOR COMPANY**

The 3 station progressive piercing and blanking die, mounted in a Producto Die Set, produces the Magnet Frame (shown at right) for Otis Elevator Company. It is used in the Magnet Switches which compose the floor selector system for automatic stops thru the push button panel.

Thickness of steel frame is .092"-.096", size 1 9/16" x 4 13/16" For this relatively rugged application a tolerance of ± .002 is maintained. Production averages 750 pieces per hour, 18,000 between grinds.

The excellent performance of this die is tied right in with the accurate alignment of the Producto Die Set guide pins and bushings and precise parallelism of punch and die holder. Rejects are minimized, die life extended and improved production assured. Specify Producto for competitive advantage in today's high production economy Send for New 72-Page Catalog No. 10 . . . complete listings of all Producto Die Sets and Accessories.

Actual size of Magnet Frame, 1-9/16" x 4-13/16"

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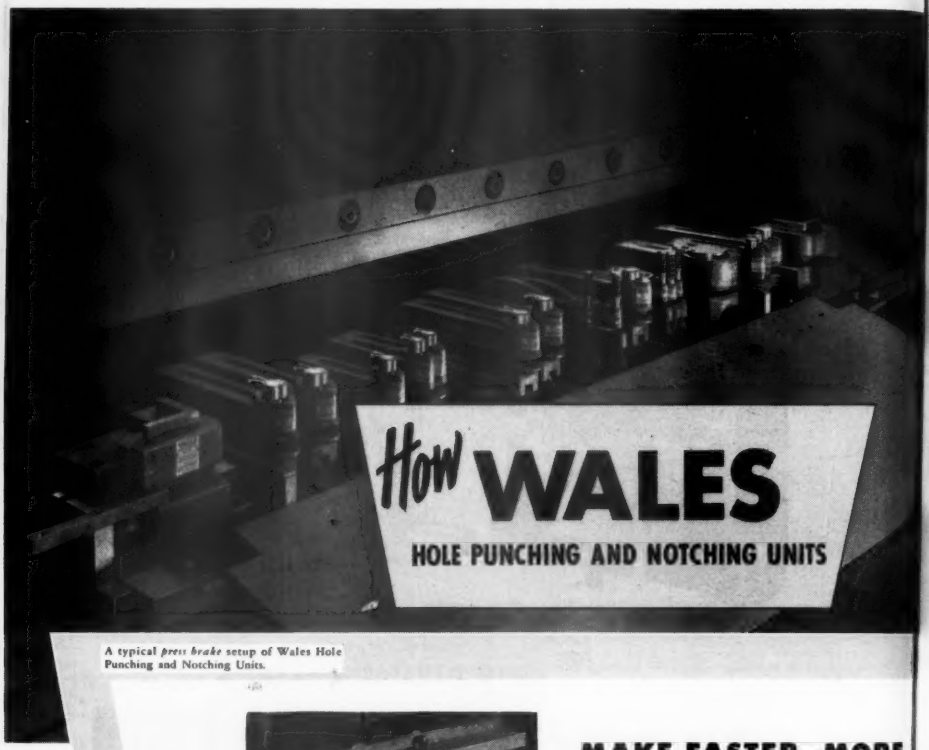
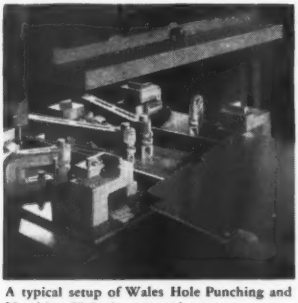


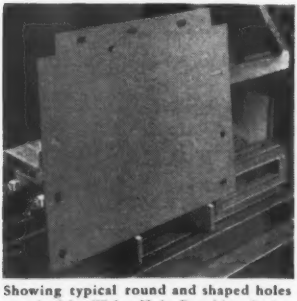
How WALES

HOLE PUNCHING AND NOTCHING UNITS

A typical *press brake* setup of Wales Hole Punching and Notching Units.



A typical setup of Wales Hole Punching and Notching Units in a *stamping press.*



Showing typical round and shaped holes punched by Wales Hole Punching Units. Note corners have been notched by Wales Notching Units.

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. . . *By eliminating* the time consuming operation of al ing each set of punches and dies.

. . . *By eliminating* special punches, punch plates, strip plates, die buttons and die plates.

. . . *By eliminating* "dead storage" of setups and tooling vestments—Wales Units drastically reduce setup and p duction time plus cutting initial and operating costs.

These tooling efficiencies are made possible by the exclu independent, self-contained design that holds all work parts as a single hole punching or notching unit. A gr of Wales Units may be set up in unlimited patterns an many cases, put into operation the same day a patter released for production.

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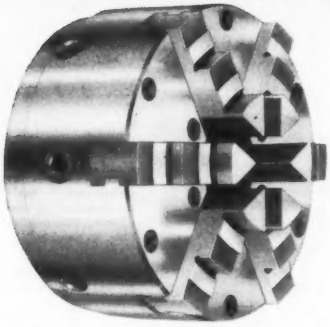

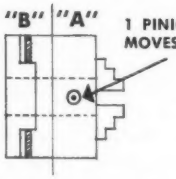

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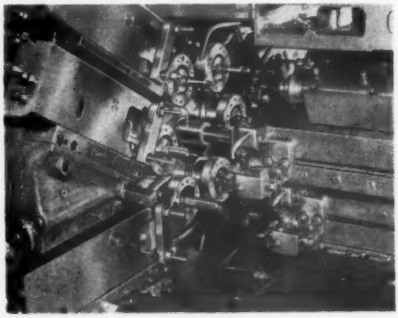


Photo courtesy Greenlee Brothers & Company.

Fig. 13: View of the tooling area, showing tooling employed for machining eccentric stud.

the irregular form generated on the work may be altered accordingly.

For this operation, the cam-generating attachment is placed on the main tool slide of a Greenlee automatic in the second position. The unit consists primarily of a housing bracket, which contains the operating cam shaft. The operating cam shaft is driven from the main gear box through one of the built-in drive sleeves. The arrangement is such that the cam shaft rotates at the same RPM as the machine spindles. Therefore, the operating cam and the workpiece rotate at identical speed. The operating cam is provided with the same contour as that required on the completed work.

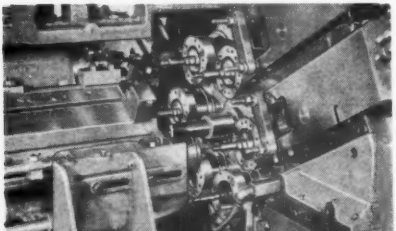


Photo courtesy Greenlee Brothers & Company.

Fig. 14: View of tooling area from opposed side of machine, showing tooling employed for machining eccentric stud.

Tool-Carrying Bracket with Transverse Motion

Mounted on the front of the cam shaft housing is a small bracket which slides up and down on gibbed ways, the motion being at a right angle to the axis of the workpiece. The bracket mentioned carries the cutting tool, and also a small roller, which rides on the operating cam to transfer the cam pattern to the tool. Strong springs function to hold the follower roll firmly in contact with the pattern cam.

While the machining operation is in process, the cam drives the cutting tool in a pre-determined pattern, while the whole unit is being moved toward the work with the tool-slide feed stroke to make the cut. Different cams may be installed in the tool if desired, to machine different contours on workpieces.

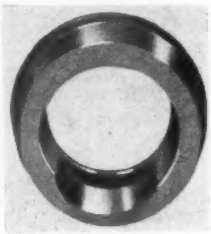


Fig. 15: Here is seen a part for an automatic screw driver, produced on an automatic screw machine, complete with the crescent shaped cam notch.

Photo courtesy Greenlee Brothers & Company.

Far removed from this type of operation is one involving relatively long workpieces, on which it is desired to turn a long straight taper. A highly-interesting method used to advantage for doing this work with dispatch involves the use of a multiple-point tool. Such a tool block or holder can be seen in one of the illustrations. The mounting bracket of this attachment is held in one of the machine's forming slides, but the forward end of the bracket incorporates dovetail ways which accommodate the tool holder proper.

Forming Slide Carries Tool to Cutting Position

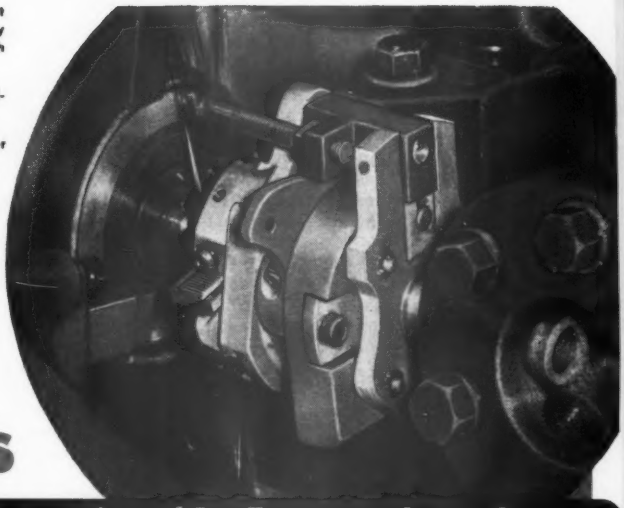
In this way, the entire mechanism is brought to the cutting position by the forming slide during the rapid-approach cycle. The toolholder proper is then advanced toward the machine spindle by

(Continued on page 100)

★ Simple, compact design combines light weight with strength, to function dependably and accurately at high indexing speeds, with long runs between grinds.

★ All important bearing surfaces are hardened and ground and hand lapped.

★ All external surfaces are chrome plated for protection.



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for Brown & Sharpe Automatics and Small Turret Lathe Applications

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No. 16-S is for use on No. 00 and 00G and No. 0 and 0G Brown & Sharpe Automatics and small turret lathes. It uses long wearing ground thread, radial type chasers *with two cutting* edges. These DUALIFE chasers are easily and quickly removed and replaced in their holders. When one edge wears out, just turn them over, and you have the equivalent of a new set of chasers. Minimum down time and maximum production result.

No. 18-S and 19-S Model 18-S is for use on No. 0, 0G and No. 2, 2G Brown & Sharpe Automatics. Model No. 19-S with wider capacity range, is for use on No. 2, 2G Brown & Sharpe machines. Both are also used on small turret lathes. They have Tangent type chasers, ground all over, incorporating the exact helix angle and thread form. They are easily removed and replaced without disturbing the head and holder assembly. Many of these chasers are interchangeable between the two models and other standard J & L Tangent Die Heads. Carbide chasers can be used when conditions permit.

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J&L ® DIE HEAD DIVISION

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and every phase of the overall picture.

This condition, with others, makes it impossible for an operator to run three machines. Indeed, it is hardly possible for him to operate even one machine efficiently. Therefore, we have sacrificed tool efficiency before we start, unless we carry the project to a conclusion.

The development of a stock elevator has not only relieved the operator of lifting the initial 2,800 pounds of material to produce 320 pieces, but will elevate into his machines the 17,000 pounds of material required to produce 1,920 pieces, without any effort whatever on the part of the operator. In so doing, 28 man-minutes per load are saved, or 168 man-minutes per day per machine, or a total 500 minutes saved on three machines.

This condition is also true of oiling equipment, chip removal, and setup condition.

Oiling has been one operation for which standard equipment is available. This has very greatly reduced lost time both of machine and operators, because an automatic can be completely lubricated in about two seconds compared with 25 minutes a day.

Chip removal is in the same category as stock loading; has been handled in the same manner, and has relieved the operator comparatively in the same proportion as stock loading.

The time required for setup and tool maintenance is the next big factor to be

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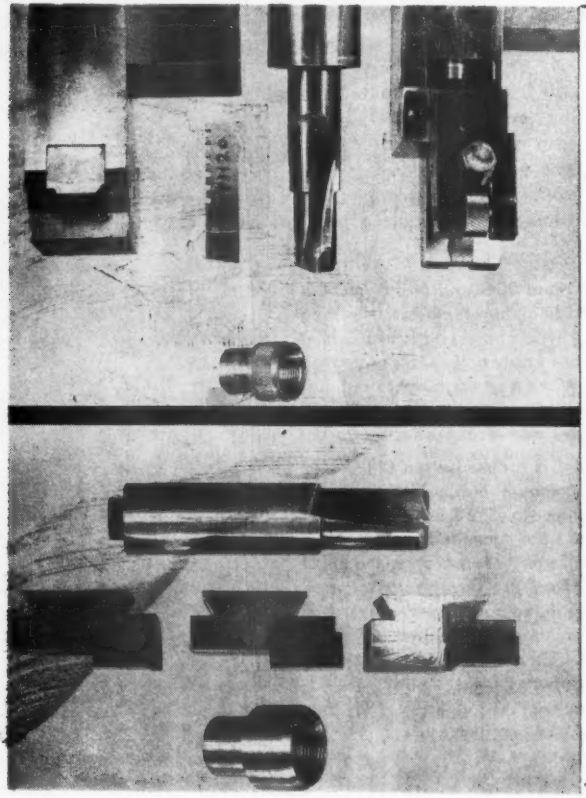

Fig. 4. The part shown in the upper panel was produced by drilling, forming and knurling. The tools employed to produce this part are also shown. They consist of a carbide tipped drill, carbide forming tool mounted in a solid block tool holder, and a knurling tool.

In the lower panel is shown the carbide tipped drill and carbide form tools used in an automatic screw machine set up to turn the sample illustrated.

When high-speed tools were used to make parts similar to these, the stock removal was around 60 to 70 surface feet per minute, and spindle speeds about 300 to 440 rpm. Since carbide drills, taps and chasers have been made available spindle speeds and stock removal have been increased from six to ten times that for HSS. Therefore parts similar to these which were produced in 90 seconds can now be produced in 15 seconds.

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- ★ Head and Table Positioning Mechanism
- ★ Vernier Depth Stop Control
- ★ Ball Bearing Drive

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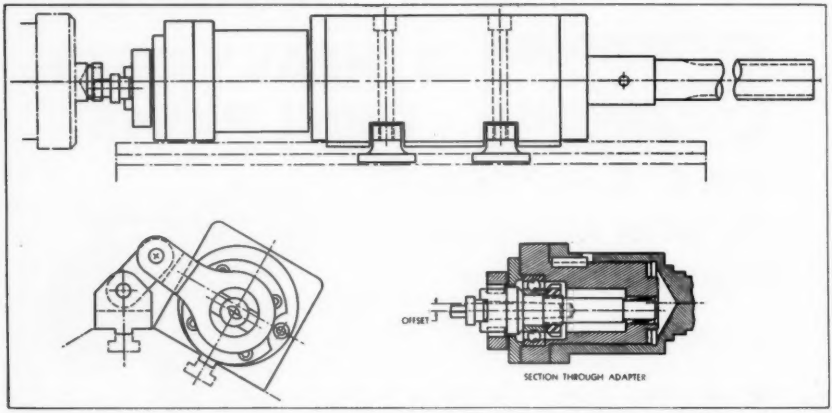

Drawing courtesy Greenlee Brothers & Company.

Fig. 16: Illustrating the attachment and arrangement by means of which the crescent-shaped cuts are machined eccentrically in parts for automatic screw drivers. A section through the adapter can be seen below, and operation is as described in text. To the left below is seen the linkage by means of which the tool spindle is prevented from rotating with the adapter.

means of a stud located on the advanced tool slide. Thus, the taper is turned. Since the toolholder is equipped with four single-point tools, equally spaced, it is only necessary to travel the tool holder one fourth of the distance which would be necessary if one single-point tool were being employed. Further, since each of the four tools cuts only a part of the taper, much longer tool life is the result. This in turn means less down time on the machine for re-tooling.

Eccentric operations at the screw machine are always interesting. One remarkable instance of eccentric machining has to do with use of an eccentric drilling attachment, which has been modified for use with a turning tool instead. It is quite often possible to take a tool which has been originally designed for one purpose, and adapt it for another, and engineers employed by screw machine manufacturers often encounter such unusual operations.

The case in mind is that of machining an eccentric pivot pin or stud. This job is done on a multiple-spindle machine, fitted with the eccentric drilling attachment mentioned. The turning tool is mounted on the center spindle of the eccentric attachment, which spindle obtains its eccentric motion by being mounted off-center in a second spindle. This second spindle is driven at work speed by a spline shaft from the gear box. It is necessary to prevent the center spindle and the turning tool from ro-

(Continued on page 104)

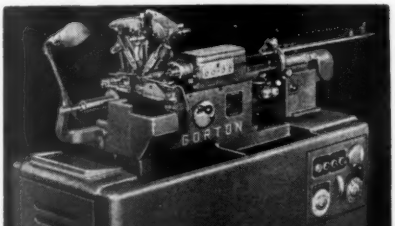

Photo courtesy George Gorton Machine Company.

Fig. 17: Pictorial view of Swiss-type automatic screw machine.

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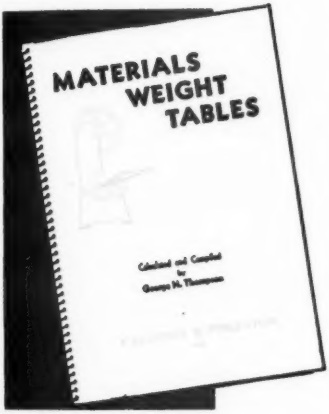

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considered.

The modern performance of automatics is almost on a tool room basis. Tolerances and finishes to 0.0005 inch, or almost a grind finish, are being held today.

However, have there been any corresponding improvements over the old methods, whereby the operator can set, adjust and maintain tools simply, speedily, and accurately? Or, are the good old fashion wrench, screw driver and above all, that grand old hammer, the pride and joy of all operators, still the operator's mainstays?

These have been and still are his common aids, and yet we expect the operator to set accurately 12 or 15 tools in a machine and produce consistently thousands of pieces.

Why not give him a break and put something on the equipment to achieve an accurate setting of tools, and help him reduce his setup time by as much as six to eight hours, with resetting a matter of minutes?

An addition to the equipment can be made where, by turn of a dial, tools can be set in any position on any slide to a thousandth of an inch of accuracy.

This can be accomplished before a spindle is turned, with the operator standing in his normal position and not on his back in the bed of a machine, or without the interference of compound or coolant oils dripping over his body.

(Continued on page 106)

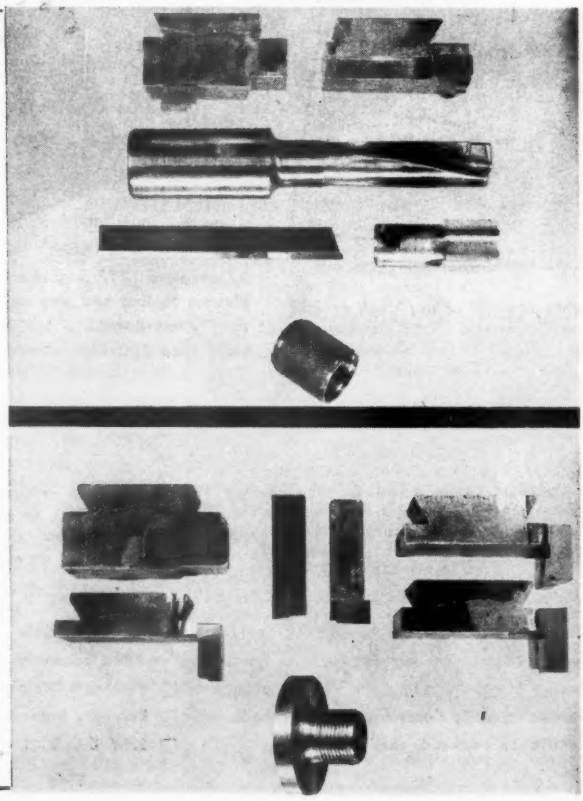

Fig. 5. The part shown in the upper panel was made from copper by the carbide tipped drill, carbide form tools, tap and cut-off tool set up in an automatic screw machine. In the lower panel is shown the carbide forming tools and thread chaser used in an automatic set-up to produce the sample. Part similar to these may require 70% of the time for drilling and threading compared to 30% turning and forming time. This is evidence of the value of the carbide drills and chasers and the part they play in the time reduction cycle. This reduction in the time cycle has a decided bearing on tool life and product finish. Because the tools are in contact with the work about one-sixth of the previous contact time, there is less heat generated in the tools and work, resulting in longer tool life between grinds and better product finish.

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tating. Such turning is prevented through use of a linkage anchored to the main tool slide.

Milling Crescent Shaped Cam Notch

Another highly-interesting eccentric operation performed on a competent six-spindle automatic is complete machining of a part which incorporates an internally-milled cam notch. This is done on a single setup, a special attachment being employed for the purpose. The attachment in this case consists of a mounting bracket, containing an eccentric adapter. A tool-holding spindle is mounted in the adapter, in turn, and a linkage from this toolholding spindle to the main tool slide is used, to keep the tool spindle from rotating with the adapter.

When the attachment is in operation, the eccentric adapter is driven at spindle speed, and therefore at the same speed as the workpiece, through a spline shaft engaging a sleeve in the gear box. The tool holding spindle is mounted offset to the center of the adapter, the required amount. Therefore, as the adapter rotates, it imparts an eccentric motion to the cutting tool. The cutting tool then produces a crescent-shaped cam notch in one side of a previously-made bore.

In order to obtain the crescent-shaped cut mentioned, it is necessary for the cutting tool to revolve on its own center at the same time it is being swung eccentrically by the adapter, and is also being fed forward to proper depth by the forward feed of the tool slide. On such a layout, it is possible to make changes in the amount of eccentricity imparted to a cutting tool, simply by varying the amount of eccentricity incorporated in the adapter.

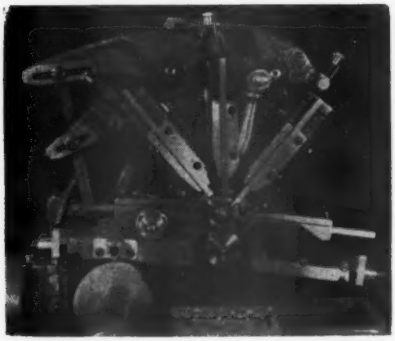

Photo courtesy George Gorton Machine Company.

Fig. 18: Looking directly at the tool frame of a highly competent Swiss-type automatic screw machine. The workpiece may be seen at the center with the five radially-disposed tools around it. The two lower tools are carried on a rocker arm, while the three upper ones work in dovetail ways.

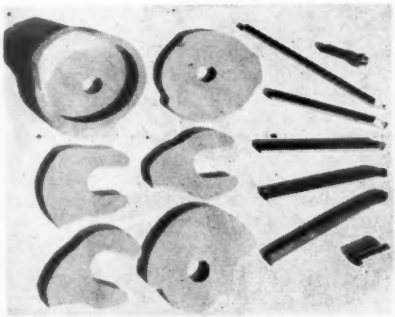

Photo courtesy George Gorton Machine Company.

Fig. 19: Showing cams and cutters of the type employed on Swiss-type automatic screw machine.

Advances in Swiss Type Tooling

Many advances in tooling and application are also being made more or less continually on Swiss-type automatic screw machines. For the benefit of any who may not be acquainted with the Swiss-type machine, it should be stated that its operating principles are radically different from those of other screw machines. The Swiss-type automatic is particularly designed and used for turning very small diameter work. Its design has evolved as the result of seeking methods adapted for turning small-diameter parts with dispatch, yet avoiding the necessity for imposing tool thrust on the side of the work, which would inevitably distort small-diameter work and result in inaccuracy.

In the Swiss-type machine, the head stock, containing a gripping collet in the spindle nose, is provided with a longitudinal feeding movement. That is the entire headstock moves forward with the revolving work as a unit. After advancing to the point where one piece of work has been completed and cut off, the headstock is retracted as the collet releases.

(Continued on page 108)

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The above are reasons enough to add this equipment, but we might also take into consideration the overhead. A setup is worth about fifty dollars. This can be reduced by about two-thirds or about seventeen dollars. The equipment would pay for itself if only setup maintenances were considered.

This reasoning could be an endless chain when every angle is considered. For example: more tool area for chips and working conditions; better and freer base surface for cleaning machines; better handling of coolants, and oil sumps could be designed for quicker and better cleaning purposes. Airmeters could be used for indicating tool wear or breakdown, and

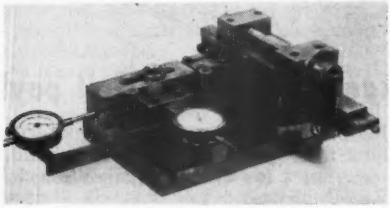

Photo courtesy General Electric Co.

Fig. 6. A calibrated tool slide for automatic screw machines makes it possible to reduce set up time as much as six to eight hours, with resetting a matter of minutes.

this is an important item. Should we not exert our imagination to the fullest extent when every development thus far explored has resulted in a tremendous relief to the operator's time and manual effort.

(6) Spindle Speeds: Spindle speeds and feeds, if correctly used, are the controlling factor in the possible performance of improved tools.

Closer fitting bearings and spindles with proper takeup adjustments, and constant and better lubrication, must be used.

As efficient, constant and greater spindle speeds are required, fifty to seventy-five precent greater motor power has not been found excessive, and is an essential requirement.

Due to the greater speeds it has not been found necessary to increase feeds per revolution to any great extent, as stock removal is automatically increased with

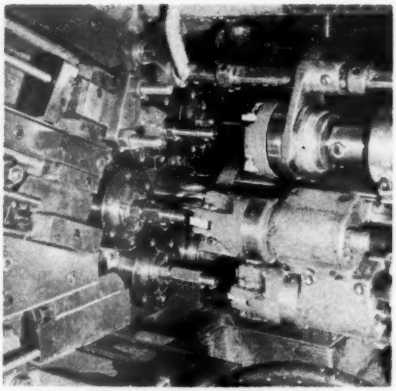

Photo courtesy Cone Automatic Machine Co., Inc.

Fig. 7. Tooling area on the front side of the 6-spindle Conomatic screw machine.

the greater spindle speeds.

(7) Lubricants: Lubricating the equipment has already been briefly mentioned but must be carefully considered. With the increase of speeds and feeds, as well as stock removal, constant and efficient lubrication is required.

(8) Coolants: As greater production is possible due to better tooling and machine conditions, so coolants play a very important part in our program.

It is my personal opinion, derived from our production experiences: First: That as tools operate at greater speeds and produce work at a greater rate, they are in contact with the piece for a much shorter period of time, since the cutting operation is reduced on an average to about one-sixth of the previous contact time. Therefore, even with greater stock removal, there is less contact or cutting time to create heat in either tools or work.

Second: That parts or tools are not, therefore, distorted by heat generated and no change is occurring from extreme heat during cutting or changing to a normal condition when dropped off. Better finishes are also an advantage for the same reason.

However, a good water-soluble cutting fluid, from an extensive and prolonged research on production runs, has been found

(Continued on page 114)

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HIGH SPEED **SPECIAL** RIGHT HAND TAPS

SIZE	THREAD
4	32-40-50-64
5	30-32-36-40-50
6	30-40-48-56-60
7	32-40
8	24-30-36-38-40-44-48
9	24-28-32-40
10	28-30-36-40-48-64
12	20-28-32-36
14	20-24-28
1/16	60-64
5/64	72
3/32	48
7/64	48-56
1/8	32-40
5/32	32-36-40
9/64	36-40
11/64	36
3/16	20-24-32
13/64	32
7/32	24-28-32
1/4	18-24-26-27-30-32-36-40
5/16	16-20-22-27-28-32-40

SIZE	THREAD
3/8	12-16-18-20-27-28-32-36-40-48
7/16	12-16-18-22-24-27-28-30-32-36-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
9/16	16-20-24-27-28-30-32-40-48
5/8	12-14-16-20-24-27-28-32-36-40
11/16	11-16-18-20-24-27-28-30-32
3/4	9-11-12-14-16-20-24-26-27-28-32
13/16	16-14-18-20-32
7/8	10-12-16-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-32
1	10-12-16-18-20-24-27-32-40
1-1/16	12-14-16-18-20-24
1-1/8	8-10-14-16-18-20-24-32
1-3/16	8-10-12-14-16-18-20-24
1-1/4	8-10-14-16-18-20-24-32
1-5/16	12-14-16-18-20-24-32
1-3/8	8-10-14-16-18-20-24
1-7/16	8-10-12-16-18-20-24
1-1/2	8-10-14-16-18-20-24-28
1-9/16	18-20-24
1-5/8	5-1/2-8-10-12-13-16-18-20-24
1-11/16	10-12-14-16-18-20-24

SIZE	THREAD
1-3/4	8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20-24
1-15/16	8-10-12-14-16-18-20-24-28
2	4-1/2 - 8-10-12-16-18-20
2-1/16	12-14
2-1/8	12-16-20
2-3/16	12-16
2-1/4	4-1/2 - 8-12-14-16-18
2-5/16	12-18
2-3/8	12-16-18
2-1/2	8-10-12
2-9/16	18
2-5/8	12-16-20
2-3/4	16
2-7/8	8-12-16
3	8-16
3-1/4	8-12-16
3-1/2	8-12-16
3-7/8	8
4	8-12

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32

SIZE	THREAD
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18

SIZE	THREAD
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-18-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
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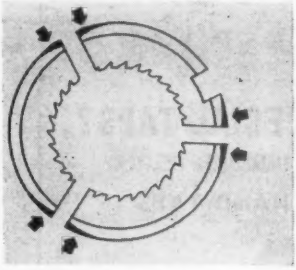

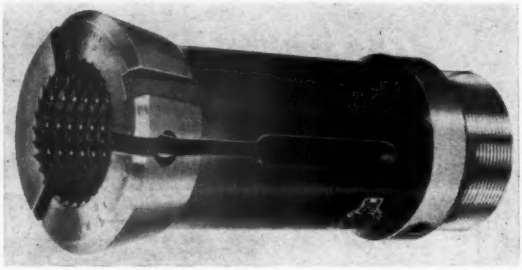

Photo courtesy Sheffer Collet Company.

Fig. 20: Sheffer's cloverleaf grind collet is slightly relieved at the section. This permits tighter draw down with less strain on the chucking mechanism.

The collet then closes on the work again, and the headstock again feeds forward for advancing and the next machining.

Located directly in front of this traveling headstock is a structure containing a guide bushing. The stock being machined, gripped by the collet in the spindle nose, is fed through this guide bushing, this bushing having no movement whatever. Five different tools are located just forward of the bushing, and are radially disposed around its extended axial line. These tools may be said to be radially disposed through an arc of approximately 180 degrees, the two lower tools being mounted horizontally on a rocker arm.

The other three tools are located above, and have their action through slides. Each tool bit is in very close proximity to the guide bushing, and therefore imposes its full cutting load on that bushing. The extended and turned portion of the piece which has already passed through between the tools is completely free of tool load at all times. This principle allows turning very small diameters of relatively long lengths, without any danger of distortion.

Cam Governs Headstock Travel

In connection with these movements as outlined, the headstock moves forward and backward under control of a cam. Likewise, cams control the movement of each of the tools. By developing the layout in such manner as to properly synchronize longitudinal feed movement of the stock with advancing and retracting movements of the individual tools, any desired shape can be turned on the workpiece with single-point tools. In cases where it is desired to process square and hexagon bars, a special revolving guide bushing

(Continued on page 123)

Photo courtesy Sheffer Collet Company.

Fig. 21: The insert of this "BB" pusher is one piece with longitudinal slits permitting it to be drawn down tight on the work. Separate pads and attaching parts are eliminated. Inserts are available in a number of materials depending on the nature of the stock being held.

Photo courtesy Sheffer Collet Company.

Fig. 22: This Economy pusher has not only ground nose bearings, but ground midsection bearings which provide a more secure grip on the bar with less pressure. This extra bearing surface also provides for grip of the bar to the end, eliminating long scrap ends and waste.

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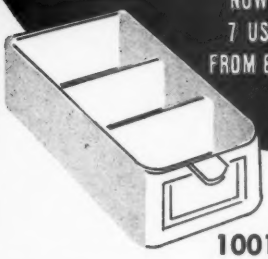

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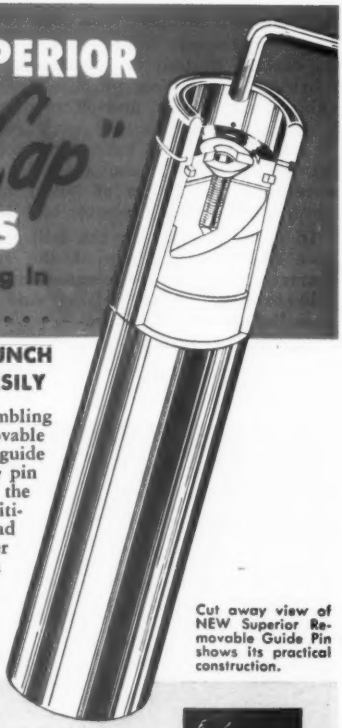
End Troublesome Binding In Die Set Assembly Work . . .



Cut away view of NEW Superior Removable Guide Pin shows its practical construction.

HEXAGON KEY REMOVES CAPS TO FREE PUNCH HOLDER . . . DIES PART QUICKLY and EASILY

It is no longer necessary to spend excessive time in assembling and disassembling large die sets! Superior's *NEW* Removable Cap Guide Pins eliminate punch holder binding on guide posts when parting dies. The cap is removed from the pin merely by loosening a socket head screw which holds the cap in place. This frees the punch holder at the most critical point of the pin where it is apt to cock or bind. Instead of needing 2 or 3 die makers to remove the punch holder from a set, one man can easily do this work alone in a few minutes. As a result overall die costs are substantially reduced. Complete information is available on request. Save by using these advance type guide pins in your die sets. Write, phone or wire your needs now!

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5. One man can remove large punch holder in approximately 3 minutes.
6. Punch holder assembled easier and more accurately.
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8. Taper seat for cap insures positive alignment.
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to give extremely better results over an oil coolant in that it contains sufficient lubricant for cutting purposes, also machine preservatives, and offers unequaled advantage in keeping the work and tools at a cool, even, and normal temperature. Its use, therefore, results in the aforementioned advantages of better quality, closer tolerances and greater tool life.

In many cases, due to the drill performance and the efficiency of the coolant, reamers have been eliminated and work held to satisfactory finishes and tolerance limits.

(9) Inspection: As parts are produced more rapidly, we should be in a position to accurately and swiftly inspect at the

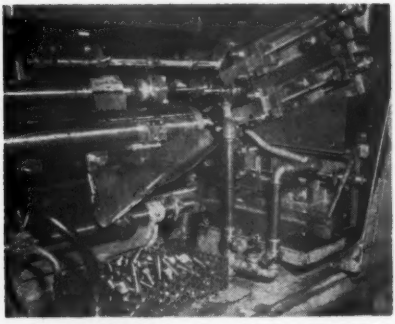


Photo courtesy Cone Automatic Machine Co., Inc.

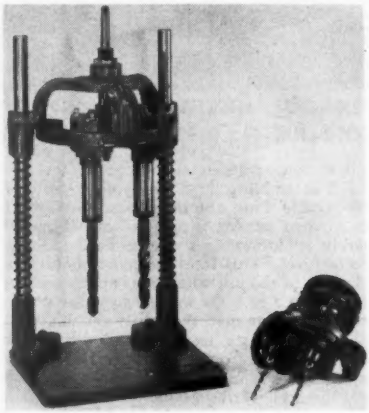
Fig. 8. Tooling area on the rear side of the 6-spindle Conomatic. The finished parts can be seen in the metal basket as they drop from the cut off operation.

machine for inferior pieces. Although better tooling, equipment, and coolants will automatically reduce waste and spoilage, pieces are nevertheless being produced at a greater rate. Where a possible 40 pieces were produced, it is now possible to produce 240 pieces per hour. For such production, inspection equipment in the nature of indicators, snap gauges or other fast reading instruments should be furnished. If an inspector were required to make his rounds once every hour, he would be inspecting a percentage of 40 parts produced whereas, at present, he is inspecting a percentage of 240 parts. Again, the

(Continued on page 137)

Drill Two Holes At One Time With Greater Center Distance

The recent addition of two larger models to the Linderme line of adjustable two-spindle drilling heads now permits drilling two holes at a time with any distance between centers up to 12⅝". Previous models were limited to 6" max. center distance, as standard.



The two new models permit variable drilling centers from 6" to 12⅝". The adjustment is made quickly and conveniently by merely loosening two hex nuts. Drill spindles are held rigidly in position when nuts are tightened.

The new model A-4 is of the sleeve type, for individual drill press quills. Model C-3 is of the over-arm type, mounted to a base plate by means of twin guide posts for increased rigidity and accuracy of drilling. The base plate is provided with surfaces ground for use with precision drilling fixtures.

Both models are available with standard Jacobs drill chucks, one-piece drill spindle for Morse taper shanks, or GM adjustable sleeves for height equalization. Either model accommodates drill sizes from 0" to ⅝".

For further information, write to LINDERME ENGINEERING & SALES, 8132 Puritan Ave., Detroit 21, Michigan, or **Circle Inform-A-Gram No. D2.**

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

M. I. T. to Conduct Special Summer Courses in Mechanical Engineering

New developments in five phases of mechanical engineering will be emphasized in special courses in Metal Cutting, Internal-Combustion Engines, Lubrication Engineering, Vibration, and Industrial Photoelasticity to be given at the Massachusetts Institute of Technology during the summer of 1952, according to Dr. Ernest H. Huntress, Director of the M.I.T. Summer Session.

The five courses, part of an C.I.T. summer program designed to meet the needs of industry, will devote special attention to machine design and manufacturing methods.

In announcing the comprehensive program, the Institute noted that present demands on industry emphasize the importance of choosing manufacturing conditions intelligently and expediently. To this end, these special courses in mechanical engineering will be based on the latest information derived from research and industrial practice.

The course in Metal Cutting, planned especially for those in industrial production, will be given from May 26 to June 6. Emphasis will be on presenting a unified picture of the metal cutting process in terms of recently developed fundamental principles.

Topics will include automic structure and physical properties of metals; mechanics of cutting; role of cutting fluids in reducing tool friction and wear machinability and tool life; thermal aspects of cutting; metallurgical aspects of machining, grinding, honing, and polishing; and three-dimensional cutting processes.

The program will be under the direction of Professor Milton C. Shaw, in charge of the Machine Tool and Metal Cutting Division of the Mechanical Engineering Department at M.I.T., and Professor Prescott A. Smith, in charge of the Machine Tool Laboratory.

The program in Internal-Combustion Engines from June 9 to June 20 will emphasize the analytical approach to performance and design problems and to the planning and control of experimental and development programs. It is planned primarily for the engineer responsible for the design and development of improved models of Diesel or Otto-Cycle engines, and for the teacher of these related subjects.

The course will be under the direction of C. Fayette Taylor, Professor of Automotive Engineering and Director of the Sloan Laboratories for Automotive and Aircraft Engines.

Lectures in the course will be followed by discussion periods and in many cases by laboratory demonstrations as well as by conducted visits to related laboratories, including those for experimental stress analysis, dynamic strength of materials and gas turbines.

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A specialized program in Lubrication Engineering will be offered from June 23 to July 3 to provide an opportunity for engineers in industry to study the application of new techniques and methods in this field.

Designed primarily for the engineer responsible for lubrication maintenance and scheduling in an industrial plant and for engineering students who are interested in taking advantage of the growing demand for men trained in this area, the program has the sponsorship of the American Society of Lubrication Engineers and other technical groups.

The course will be under the direction of Professor Brandon G. Rightmire, Assistant Professor of Mechanical Engineering and in charge of the M.I.T. Lubrication Laboratory. He will be assisted by other engineers from the Institute's staff and by representatives from industry who are authorities in their fields.

Newest developments in the field of Vibration will be reviewed in a special two-week course offered by the Departments of Mechanical Engineering and Aeronautical Engineering from August 4 to August 15.

The program will be under the direction of Professor Jacob P. Den Hartog, who has specialized in the general field of vibration for 25 years and who is in charge of the Applied Mechanics Division of the Mechanical Engineering Department.

In commenting on the significance of the course, Professor Den Hartog noted especially the radical change in instrumentation requirements created by the trend toward higher and higher frequencies in mechanical vibrations of machinery, particularly in engine torsionals and in turbine blading. He also pointed out that extensive knowledge of vibration is very desirable to an understanding of the field of servomechanisms.

Because of the increasing need for formal instruction in the photoelastic method of stress analysis, a special two-week course in Industrial Photoelasticity will be offered from Aug. 18 through Aug. 30.

Designed primarily for the practicing engineer with no previous knowledge of the subject, the course will be under the direction of Professor William M. Murray, who is in charge of the Laboratory of Experimental Stress Analysis.

Included in the program will be a survey of the field of photoelasticity and its uses and a discussion of experimental techniques and equipment. Emphasis will be placed on the applications of the photoelastic method of stress analysis to industrial problems.

All facilities of the Institute will be open to members of Summer Session courses. Living accommodations will be available in M.I.T.'s Alfred E. Burton House, overlooking the Charles River Basin and the Boston skyline, to those who specifically request reservations in their applications for admission.

Early application is advisable since enrollment in all courses is limited. Requests for application forms or for further information on these and other special summer activities at M.I.T. should be addressed to Dr. Ernest H. Huntress, Director of the Summer Session, Room 3-107, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Foundations of Defense*

Gentlemen of the Westinghouse Machine Tool Forum:

It is a signal honor to be invited for a second time to address the Westinghouse Machine Tool Forum and I am especially glad to be able to do so on this occasion as the official representative of our nation's machine tool industry.

The electrical aspects of machine tool design are acquiring growing importance. Just as the great developments of the 19th and early 20th centuries were in the mechanical field—the mechanical tracer, the geared-head lathe, the substitution of

by **Frederick S. Blackall, Jr.**
President and Treasurer
THE TAFT-PIERCE MANUFACTURING CO.
Woonsocket, Rhode Island
and
President
NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION

sliding gear selective transmission for the belted cone pulley and change gears, so as we stand on the brink of the second half of the 20th century electrical controls are displacing mechanical to an increasing extent. Now we face an even newer era—that of electronics. It appears more than probable that the ingenuity of the machine tool electrical engineer may one day all but do away with the "quick-change" mechanics which were the wonder of another day. The age of the gear and the screw give way to that of the vacuum tube, the photo-electric cell and now, perhaps, the transistor. These and the air circuit afford potentially fruitful areas of research for you technicians of the electrical age of machine tool design.

It is fitting that the President of the National Machine Tool Builders' Association should pay tribute to the close relationship which the great Westinghouse Electric Corporation has fostered and maintained with the machine tool industry. Ever since 1937 the Westinghouse Machine Tool Forum has provided an unparalleled opportunity for the constructive interchange of opinion and ideas between the technical leaders of the electrical industry and the machine tool builder—a congress of debate and suggestion which must certainly have made its impress upon the developments to which I already have made reference. This mutual exchange of thought is in the finest tradition of American industry and stands in contrast to the secretiveness of the Old World where businessmen have yet to learn that when they lift the curtains which shade their windows, they let in more light than they let out!

The men of Westinghouse like most of the members of our own industry, have been leaders in the field of standardization, an activity which is another of those gifts —not always accepted with acclaim— from the New World to the Old. Those who have contributed to this effort invariably have found that they have gained far more than they have lost, if indeed they ever lose anything in the dedication of progressive ideas to the public use.

I am impelled to say a word in this connection however, with reference to the quality of electrical standards which now exists in our own field due to the parallel development of the J.I.C. and N.M.T.B.A. Electrical Standards. There is no more excuse for two electrical standards in this industry than there is for a conventional geared transmission along side a fluid job in a modern automobile. I submit that the technical staffs of machine tool consumers and machine tool builders who jointly dominate the standards activities in this field, many of whom doubtless are present here today, should get their heads together to eliminate this anomalous situation. It is wasteful and costly to builder and consumer alike.

It is unconscionable that such an uneconomic divergence of ideas should prevail for long among men of good will with common objectives. I do not wish to take sides in this controversy (though as a machine tool builder I might be pardoned for doing so) but I wonder if the presence of a comptroller or two, or perhaps a vice president in charge of purchasing with a

(Continued on page 124)

* A paper presented at the 16th Annual Machine Tool Electrification Forum, sponsored by Westinghouse Electric Corporation, Pittsburgh, Pa., April 1 and 2, 1952.

. . . **Machinability, from page 74**

stant—plus the hardness, strain hardenability, and the amount of abrasive particles on the metal all affect the inherent machining qualities of the alloy. Figures 4 and 5 summarize the effect of these factors upon the inherent machinability of some high temperature alloys.

Design of The Part Being Fabricated

Basically, the axial-flow gas turbines consist of a series of thin-walled circular elements bolted together and containing the rotating elements. The design trend is to larger diameters and still thinner sections so that increased thrust can be developed for a minimum engine weight. Figure 3 shows a cutaway section of a prototype of present Westinghouse engines but is still useful for this discussion.

These parts are made from material that is received in the cast or forged condition as sheet metal or bar stock. In the cast condition, the part is cast as close to shape as is practical and then given a solution anneal to establish its optimum machining condition. Centrifugal castings are used to an ever increasing extent.

One part, a large diameter turbine shaft, first weighed close to 1000 pounds as a solid forging. When this part is completely machined it weighs only 60 pounds! This means extensive machining time. By going to a centrifugal casting or to an extruded and upset tubing it will be possible to make large savings in the total time required to completely machine

Fig. 4. Showing the nominal physical and machining properties of high temperature alloys.

NOMINAL PHYSICAL AND MACHINING PROPERTIES OF HIGH TEMPERATURE ALLOYS

		Condition	Brinell Hardness	Shear Str. in Cutting PSI X1000	Mayer Exponent	Unit Power HP/Cu.in./min
TITANIUM	Ti 150A	As Forged	320	105	2.07	1.55
	RC 130B	As Forged	320	110	2.10	1.55
	FDS 9468	As Forged	300	110	2.15	1.57
STAINLESS STEEL	AISI 347	1/2 Hard	202	109	2.20	0.97
	AISI 410	Annealed Harden and Tempered	190 300	97 109	2.27 2.11	0.92 0.92
	Inconel "X"	Solution Tr. S.T. & Aged	220 310	121 140	2.27 2.05	1.30 1.70
SUPER ALLOYS	Refractaloy 26	Solution Tr. S.T. & Aged	152 270	127 168	2.20 2.15	1.08 1.38
	Discaloy 24	Solution Tr. S.T. & Aged	150 270	120 132	2.24 2.07	1.04 1.14
	Timken 16-25-6	Solution Tr. Work Hardened	187 374	115 127	2.24 2.09	1.05 1.19

EFFECT OF BASIC MECHANICAL QUANTITIES ON FORCES, SURFACE FINISH & TOOL LIFE

Property of metal being cut	A decrease in the given property has the following effect:		
	Known effect on forces and power consumption	Usual effect on surface finish.	Probable effect on tool life
Machining constant, C	Rad	?	Rad
Shear Strength, Ss	Good	None	Good
Coefficient of friction, M	Good	Good	Good
Hardness, H	*	None	Good
Strain Hardenability, n	*	Good	Good
Amount of abrasive particles	*	None	Good

*Do not contribute

Fig. 5. The effect of basic mechanical characteristics on forces, surface finish and tool life.

the part. This will also reflect extensive savings in tooling cost.

Compressor disc forgings once purchased as pancakes, now are obtained as contoured forgings. Each of these changes have been made to reduce the amount of machining time on these high temperature alloys.

Because the jet engine has to be in perfect static and dynamic balance, the close tolerances that have to be maintained on all parts pose another problem. A finish-machined compressor disc has a cross-section of less than 0.100 inches in some places. If you have ever tried to remove a few thousandths of an inch from a material which is not fully stress-relieved you know what happens—it distorts. This will occur on a disc which is not stress-relieved. The English engineers have overcome this by finish-machining both sides of a disc simultaneously. American manufacturers should consider this inasmuch as the present trend in disc design does not indicate thicker sections.

Most parts are designed with liberal radii to prevent stress concentrations. Sometimes through the oversight of the designer many different radii will be incorporated in the same part. This raises a machining problem which will be dealt with more fully in a later section. At the present time, it necessitates a considerable amount of hand feeding and blending.

Design and Type of the Cutting Tool

The use of materials that contain very hard carbide particles in a tough matrix, such as the high temperature alloys, necessitates the use of tools that are abrasion and shock resistant, and have high hot hardness. Carbide tooling is common

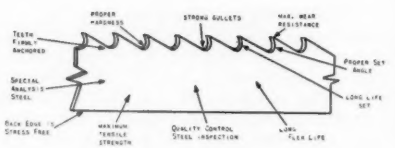
(Continued on page 145)

. . . Friction Sawing, from page 84

Steady feeding pressure is highly important when friction sawing. When first putting the work into the saw there is considerable resistance. As friction through blade speed heats and softens the material directly in front of the saw teeth, cutting action takes place immediately in thin sections and within a second or two in heavier ones. It is at this point that heavier feeding pressure must be introduced and held uniformly until the cut is completed.

Heat Penetration

Heat penetration due to friction sawing is negligible, it increases slightly with thicker materials but skin hardness never exceeds .002" in depth. Friction sawing solves many problems of distortion caused by heat generated in the course of varied machining operations. The process often supersedes torch cutting to eliminate a secondary operation. In the



Quality and Safety Features of New Friction Saw Bands

case of heat treated materials that respond to air hardening techniques, the air entrained in the rapidly moving saw cools the material so quickly that the usual superficial Rockwell testers will not give measurements cut to the thin zone of hardening. Behind the zone of hardness will be found an extremely narrow annealed area which also applies to heat treated materials that do not respond to air quenching. The under burr from friction sawing is also negligible, being

(Continued on page 122)

MATERIALS	Saw Velocity Work Thickness			Saw Pitch Work Thickness			Approx. Lin. Cutting Rate (in./min.) Work Thickness				
	1/16"-1/4"	1/4"-1/2"	1/2"-1"	1/16"-1/4"	1/4"-1/2"	1/2"-1"	1/16"	1/4"	3/8"	3/4"	1"
Carbon Steel (S.A.E.) #1010-1095	6,000	9,000	12,500	14	10	10	1400	60	30	8	6
Manganese Steel #T1330-1350	6,000	9,000	12,500	14	10	10	1200	55	25	7	5
Free Machining Steel #X1112-X1340	6,000	9,000	12,500	14	10	10	1400	60	25	7	5
Nickel Steel #2015-2515	8,000	12,000	14,000*	14	10	10*	800	45	20	5	3
Nickel Chromium Steel #3115-3415	8,000	12,000	14,000*	14	10	10*	800	45	18	5	3
Molybdenum Steel #4023-4820	8,000	12,000	14,000*	14	10	10*	1000	50	20	6	3
Chromium Steel #5120-5150	8,000	12,000	14,000*	14	10	10*	800	45	18	5	3
Chromium Steel #51210-52100	8,000	12,000	14,000*	14	10	10*	800	40	15	5	3
Chromium Vanadium #6115-6195	8,000	12,000	14,000*	14	10	10*	700	40	15	5	3
Tungsten Steel #7260-71360	8,000	12,000	14,000*	14	10	10*	600	38	12	4	3
N. E. Steel #8024-8949	8,000	12,000	14,000*	14	10	10*	800	45	20	6	3
Silicon Steel #9255-9260	8,000	12,000	14,000*	14	10	10*	600	45	16	4	3
Armor Plate	7,000	10,000	13,500	14	10	10	1200	60	30	6	5
Stainless Steel	7,000	10,000	13,500	14	10	10	1200	60	30	8	6
Illium	8,000	12,000	15,000*	14	10	10*	600	35	12	3	2
Cast Steel	7,000	10,000	13,500	14	10	10	1000	50	16	7	5
Gray Cast Iron	7,000	10,000	13,500	14	10	10	1000	55	20	7	5
Malleable Cast Iron	7,000	10,000	13,500	14	10	10	1000	55	20	7	5
Meehanite Castings	7,000	10,000	13,500	14	10	10	1000	55	20	7	5

Timken Installs Machine Tool Lubrication Program

A preventative maintenance program is being used by The Timken Roller Bearing Company. The program includes mechanical inspection, electrical inspection, and lubrication. Last year systematic lubrication was inaugurated to strengthen the preventative maintenance project. The proper lubricant and the proper frequency of lubrication, and the testing and improving of new lubricants is the purpose of this project.

The lubricating schedule is accomplished in this manner: Plasticized lubrication cards are attached to each machine. Each card indicates the lubricants to be used in all parts of the machine. The frequency of lubrication, types of lubricants and methods of procedure appear in a separate lubrication manual used by the Maintenance Department.

Since The Timken Roller Bearing Company buys its lubricants in large quantities, they have found it economical to blend their own lubricants to gain those special qualities needed in oil for a particular job. For other conditions, special purpose oils are purchased.

The object of this systematized lubrication program is obviously to decrease maintenance costs and lost time. Timken Roller Bearing Company engineers say that it will be necessary to use the system for several years before concrete evidence can be obtained which will measure the system's value in dollars and cents.

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344 Midland Ave. • Detroit 3, Mich.

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Friction Sawing, from page 120

1/8" at the most, and is readily removed especially by band filing. The saw teeth can stand the excessive heat generated by friction because the band travels at speeds often reaching 14,000 fpm. No part of the blade therefore contacts the work for more than an infinitesimal part of a second so any heat generated is dissipated previous to its re-entering the work.

The degree of material hardness is immaterial but the various alloys added to the iron will change the softening characteristics of the steel. The amount of heat at the point of contact between the saw and the material must be changed to meet individual conditions, and more heat is required as material thickness

(Continued on page 139)

Friction Sawing Data (Sheet - Bars - Castings)

Saw Width Selection Based on Material Thickness and Minimum Radius

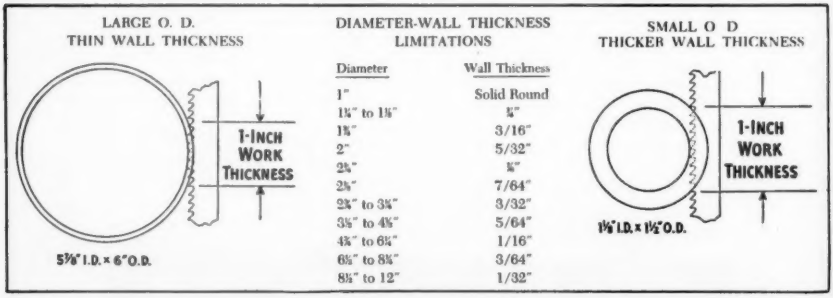
Maximum Work Thickness	Minimum Blade Width	Minimum Radii Cut
3/8"	1/2"	5"
3/4"	3/4"	8"
1"	1"	15"

Note: Special 1/4" - 3/8" and 5/8" widths available.

Friction Sawing Data (Pipes and Tubes)

Typical Comparative Production Test

Recommendations	Low Speed Sawing	Friction Sawing
Saw Temper	A	A
Saw Set	0.042 Raker	0.057 Raker
Saw Pitch	10 teeth per inch	10 teeth per inch
Saw Width	1/2 inch	1 inch
Saw Velocity	150 feet per minute	9000 feet per minute
Feeding Pressure	25 pounds - HYD	40 pounds - HYD
Lubricant	None	None
Cutting Rate	3 1/2 in. tube - 0.94 min/cut 2 in. tube - 0.65 min/cut	3 1/2 in. tube - 0.14 min/cut 2 in. tube - 0.06 min/cut
Type of Finish	Good	Good - Slight burr



Diameter	Wall Thickness
1"	Solid Round
1¼" to 1⅛"	5/32"
1⅛"	3/16"
2"	5/32"
2⅛"	5/32"
2⅜"	7/64"
2⅝" to 3¼"	3/32"
3⅜" to 4⅜"	5/64"
4⅜" to 6¼"	1/16"
6⅜" to 8⅜"	3/64"
8⅜" to 12"	1/32"

. . . Screw machine, from page 108

holder is employed. The bushing has an opening to suit the cross section of the stock and revolves with the material.

Different attachments are available for use with this machine, most of which are designed for such end-working operations as may be involved. There is a single-spindle drilling attachment, a single-spindle threading attachment, and also a three-spindle attachment. The three-spindle attachment mounts against a scraped surface on the front part of the machine, and carries three work spindles. Two of these spindles are limited to spot centering, drilling, and reaming. The third spindle may also be used for these operations but is primarily designed for heads.

The travel of these three spindles is obtained from a common lever, which derives its motion from a bell-type cam. The positioning of spindles is controlled by two flat cams. Power for revolving the second and third spindle is obtained from the main drive shaft in the base of the machine. The first spindle does not rotate. Consequently, no provision is made for revolving it at any time. A screw-slotting attachment is also available for this type of machine. This attachment differs little in principle from any of the conventional screw machine slotting attachments. When used, it is mounted in place of number three tool, leaving four single-point tools still available for turning operations. Four tools are generally more than sufficient for screw production.

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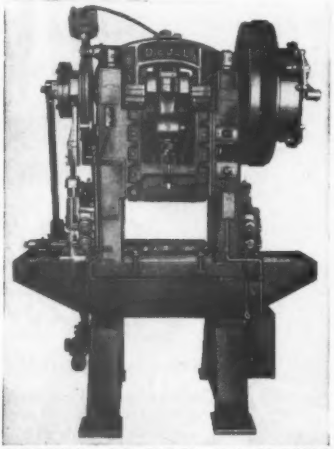

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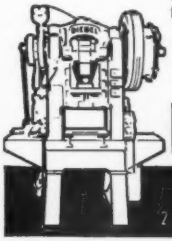

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. . . Defense, from page 118

good technical background might not be a worthy addition to the personnel of the committees which are charged with the development and promulgation of these standards. Basically, the rift in the lute is one wrought by comparative costs. The machine tool builder—may it ever be so—is impelled at all times by the urge to produce the optimum result at the lowest possible price. It seems footless and wasteful to him to have to demand two or three hundred dollars extra from his customer to provide electrical apparatus which, from where he sits at least, will do the same job, in a different manner to be sure, but in most cases no more safely, not as conveniently, and no better. Please understand, I generalize and my critique may not—probably does not—apply in all cases; but be assured, gentlemen, that the anguished cries of many machine tool builders indicate that it does in a substantial number of cases.

Let us apply our technical, as well as our economic intelligence to the stemming of the forces of inflation. I urge you engineers and you men of top management who must in the final analysis foot the bill, to do something about it. As to the final issue, the machine tool industry which like any other purveyor of goods, desires to give the public what it wants, awaits your command. But please remember, fellow consumers (for we are consumers, too), that you are the ones who will have to pick up the check! And in those recurring periods when the rapid production of machine tools becomes the critical element in getting there "fustest with the mostest," consideration should certainly be given to maximum simplicity so long as it is consistent with efficiency and safety.

To move to broader considerations, perhaps a word is in order as to the status of machine tools in relation to the national defense. The machine tool builder occupies an unique and not altogether enviable position. Between cyclical spurts of industrial activity, he becomes the forgotten man, engaged in a life and death battle with a private depression of his own. Sometimes this occurs when the consumer goods industries are enjoying a boom of no mean proportions. Then as he struggles to meet a dwindling payroll, he is greeted with headlines in every morning paper to the effect that the business index has hit a new high. It

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is not easy to avoid an inferiority complex under such conditions or even to wonder with wry and nostalgic irony how an industry which only a few short months before was being proclaimed the very cornerstone of the nation's security, could be allowed to fall upon such evil days!

It was in such an atmosphere of despair and distress that the machine tool industry heard its call to the colors for a second time within a decade when our troops entered Korea in June 1950. We knew full well what we were to be called upon to do. Furthermore, the pattern of our needs, if we were to meet that call, was clear enough — immediate priorities for materials; assistance and protection in recruiting manpower; money and credit for working capital. These techniques, forged in the fires of World War II, had been proven workable and effective. It would only be necessary to reinstate them promptly,—and a relatively simple thing to do. With these—and a minimum of time for hands experienced in tooling—we could turn out machinery in whatever quantities might be required.

That, then, was the burden of our song, when within a few short weeks after Korea, we made our 1950 debut in Washington circles. But we were to learn to our sorrow that the lessons of World War II had been forgotten. Our pleas for rapid and effective action were regarded in most quarters as merely the vapid and transparent lobbying of another industry seeking special privilege and preferment. As we pressed our points with increasing vigor, warning all and sundry of the coming machine tool bottleneck, we were cautioned by many—some of them genuine friends of the industry—that we were acquiring in administrative circles the reputation of cry-babies and self-seekers. Occasionally, of course, an understanding public servant would see the wisdom of our urging, but for months such flashes of hope were to be shattered by the sympathetic explanation that our suggestions, though sound, were "contrary to administrative policy."

It was not indeed until a full year had passed that some really effective steps were taken on a broad front in Mr. Charles E. Wilson's directive of July 1951 calling for constructive cooperation on the part of government with respect to material priorities, credit assistance, pool orders, and such help as could be afforded at such a late date with respect to manpower. Under his urging, too, the senseless

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price restrictions which had forced most machine tool builders to sell 1951 machines at 1947-49 prices, were replaced with a more realistic price formula.

Despite the discouragements of those first 12 months, the industry, lifting itself by its own bootstraps, so to speak, doubled its production between January and December 1951, and with an increasingly understanding administrative point of view in Washington, will probably double it again in 1952. But the volume and prospect of orders has been mounting even more rapidly. Machine tools are still one of the major bottlenecks of defense production. They will probably continue to be so for some time to come. But we are giving this job everything we've got, gentlemen.

"Giving" is the right word, too, for let it not be forgotten that every time we are put through the hoops of one of these orgies of production, for which, believe me, we have no desire, we sell ourselves down the river through the destruction of our future markets for years to come. Then during our brief passage across the stage we are "discovered" by Congressman and Senator, by reporter and publisher, by columnist and investigator, and not least of all by tax-collector and renegotiator. All at once you read of the "booming machine tool industry" and its "record profits." Soon we are bled white through taxation and renegotiation of the discounted earnings of future years on a current income basis. Little men whose audio-amplification stands in inverse proportion to their mental wave-length angrily demand "What's the matter with this machine tool industry that, with its fat profits, it cannot conjure rabbits out of hats?" I often wonder if there's another industry which comes closer to performing that feat of legerdemain.

Am I bitter about all of this? Not at all, gentlemen —just a trifle wistful over the shortness of man's memory and especially of that of the administrative mind. For three times during my lifetime and that of many of you here, I have seen this happen, and then seen this crucial industry, which is the very cornerstone of our national security subside into an oblivion from which a dangerous number of its members always find it impossible to rise, because the ravages of an unrealistic tax policy have deprived them of reserves necessary to survival of inevitable drought.

If I were to suggest the nations most urgent need in the field of long term defense planning, it would be

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this: a thoroughgoing and continuing recognition by the Congress, by the administrative branches of government (not forgetting the Treasury and the Renegotiation Board), and by the Military Services, of the vital importance of the machine tool industry as the basic foundation of national defense. It is high time that something were done about it.

The problem is not a simple one. No machine tool stock-piling program, for example, can be effective if not indeed detrimental to our economy unless it includes detailed and wise procedures which will keep the reserve up to date and yet dispose of the periodically discarded surplus without at once prostrating the machine tool builder, and foisting unused but nevertheless obsolete machine tools upon American industry. But it seems obvious that the establishment of some sort of permanently operating national machine tool reserve program is essential to our security. In an atomic age, time may not always be on our side.

A stand-by plan of priorities should be enacted to provide for money, men, materials and manufacturing — which could be invoked by executive order upon a moment's notice in time of need—a D-Day program to be kept constantly up to date—and one which will not be thrown into the discard as others have been, when the real pinch comes.

Our tax laws, now largely a hodge-podge of administrative interpretation and legislative amendment, need to be overhauled with a forthright recognition of what is needed to keep a strong nation strong. This will not be accomplished, my friends, if political considerations catering to the weakest elements of society continue to govern our decisions.

The provisions of our tax laws and regulations relating to depreciation allowances should be drawn in such manners as to stimulate rather than to discourage the constant modernization of our national industrial plant, not as an emergency measure for use only when the enemy is at the gate, but as a permanent cornerstone of tax policy. The shortsighted and arbitrary internal revenue restrictions which now prevent recovery, within a reasonable period, of capital invested in production equipment, and in some cases prevent its recovery at all, should be removed without delay. Indeed, such action has been recommended repeatedly by leading Democrats and Republicans alike, including the late President Roosevelt;

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but the Treasury has effectively blocked any constructive move in this direction, except with respect to emergency defense plant and equipment.

If we are to remain industrially robust, there also must be a greater recognition, in our tax policy, of the special problems and special needs of highly cyclical industries. When will government face the fact, which every economist knows, that the basic difference between prosperity and depression reposes in the welfare of the durable gooods producer? The principle of carry-back carry-forward is nullified if renegotiation siphons off all but a pittance of the machinery manufacturer's earnings which are registered during one of his occasional years of plenty. The relief provisions with respect to the Excess Profits Tax base should be made really effective, if cyclical producers are going to be kept strong enough to survive the dips in their business curve.

These are but a few of the things which need to be done if our nation is to achieve its potential destiny. Their accomplishment will require a high order of statesmanship—which really means, in the final analysis, nothing more than a forthright recognition of what is in the national interest, a certain amount of common sense, and an abiding spirit of intellectual and moral integrity in government. God grant that we may be given these things. We have waited for them long, O Lord.

But, if we scatter our resources, place votes above values, and make success suspect if not indeed a crime, we shall go the way of every nation in history which has insulted the intelligence and native decency of its people by assuming that bread and circuses were the perfect pablum for currying their political favor. The trouble is that subsidy is something like sin—the fellow who is subjected to it knows it's wrong, but most folks, even you and I sometimes, find it hard to resist if it is pressed upon us. Down deep, however, we'd rather not be exposed to it. In our heart we are more inclined to contempt than to admiration for the person who leads us astray. The pimp has never been a heroic figure in history!

The National Machine Tool Builders' Association has committees working on most of the problems which I have mentioned. They are the problems of all industry, and in our great industrial democracy, problems of all the people. Let's pull together and see if we can't lick them!

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Defense Contract Pricing

Application of established commercial practices in government procurement is sought by the Chamber of Commerce of the United States.

The Chamber's recommendations are contained in a report issued today by its Department of Manufacture bearing the title "Defense Contract Pricing".

"Since it can be expected," says a foreword by Stanley C. Allyn, president of the National Cash Register Company and chairman of the department making the report, "that an increasing number of manufacturers will be undertaking government defense production, it is important that government procurement policies be made effective. Those policies should be changed to incorporate tested business and accounting principles. Our report proposes improvements in government contracting which have long proved effective in ordinary commercial transactions."

The report covers both fixed-price and cost-reimbursement types of government contracts.

Recognizing that pricing of new products or products new to a manufacturer may be difficult in the absence of production experience, the report points out that price is the object of negotiation, with costs as only one element of price. Were this fact accepted and applied by the armed forces, then the rate of profit could be negotiated at the outset.

When the armed forces and the contractor disagree on the allowability or allocability to the contract of certain costs, the contract should contain a procedure for resolving such specific differences before the contract is executed.

By adopting these principles the armed forces could achieve greater efficiency and reduced costs through recognition of the profit incentive.

Inquiries Go Up In Smoke

Visitors at the PRATT & WHITNEY ASTE EXHIBIT Monday and Tuesday March 17 and 18 who requested literature and information are asked to duplicate their requests direct to Pratt & Whitney, West Hartford or any nearby branch office. The P&W tradeshow display was one of those completely destroyed by fire Tuesday night. The destruction included all inquiries received up to that time. Literature and specific information will be released promptly.

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Reminders for the Selection of Abrasive Wheels

Grinding wheels are available in such a wide variety of combinations of hardness, bond, grade, grain, size and structure that wheel selection must be made with due consideration of these characteristics.

Hardness

This is the scratching ability of the wheel to resist breakage; an important quality which must be duly considered. For instance, an aluminum oxide wheel is tough and not easily fractured. Consequently, such wheels are preferred for heavy cuts on high tensile strength materials, which set up higher stresses, such as carbon steels, alloy steels, highspeed steels, annealed malleable iron, wrought iron, tough bronzes and so forth. For less heavy cuts, a modified form of aluminum oxide is the choice of many shopmen. For precision operations on high speed steel, special alloys, and similar operations, where cool, fast-cutting action is needed, many shopmen prefer especially refined aluminum oxide which is still more friable than the regular type.

For work on saws and knives, to mention other items, many shopmen prefer aluminum oxide abrasives which have a toughness and brittleness midway between those of the regular aluminum oxide and the specially refined ones.

Instead of aluminum oxide, still other jobs demand wheels which have silicon carbide built into them. Wheels of this type fracture with sharper grain and are preferred for work on low tensile strength materials and for workpieces made of hard and brittle materials. Gray iron, cast iron, chilled iron, very hard alloys, cemented carbides, brass, soft bronzes, aluminum, copper and marble are in this class.

Bond of Wheel

The grains of the wheel are bonded to each other by a bonding material which holds the abrasive grains in the desired form and shape of the wheel. There are five basic bonding materials: The vitrified products of clays and glasses; silicate products such as silicate of soda; synthetic resin products such as resinoid; vulcanized products such as rubber; and elastic products such as shellac. Any one

These notes or reminders pertaining to the selection of grinding wheels are taken from DEFENSE PRODUCTION AIDS, Department of Commerce, as compiled by Joseph De Feher, Office of Technical Services. Ed.

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of these bonds may be used with either aluminum oxide or silicon carbide.

The vitrified bond: This is considered by most grinders strong and good enough for rapid removal, or for precision grinding.

The silicon bond: Large wheels are usually made with this bond as it releases grains rapidly, resulting in a milder action than that of vitrified wheels and keeping the generation of heat to a minimum. This is reason enough for many shopmen to use them for sharpening edged tools.

Resinoid or rubber bonded wheels: More resilient than the other wheels. Therefore, they are preferred for very high quality surface finish grinding.

Shellac bonded wheels: These are capable of producing high finishes on camshafts and mill rolls and so forth. They are cool cutting on hardened tool steels and thin sections.

Grade

This means strength of of bond, i.e., the strength with which the bond grips the abrasive material in the wheel. As the physical properties of the workpieces to be ground have a great influence on the grade to be used, in general, hard grade is recommended for soft materials and soft grade for hard materials. The harder the materials, the softer the grade should be.

The larger the wheel, the greater the arc of contact and the softer the grade should be. The higher the wheel speed, the harder the resulting action, and therefore, a softer grade is selected. The more rigid the machine and the spindle, the softer the grade.

The smaller the area of contact, the harder the grade should be. The higher the work speed in relation to wheel speed, the harder the grade. A harder grade of wheel can usually be used if the coolant is selected with utmost care. Use of coolant often permits the use of harder grades.

Selecting the Grain Size

This is the element which does the actual job of cutting. The size of grain depends upon the amount of material to be removed, the finish desired, and the physical properties of the material to be ground. The softer and more ductile the material, the coarser the grain size should be. Also the larger the amount of stock removal

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which is desired, the coarser the grain size which should be selected. Conversely, the finer the finish required, the finer is the grain size which is chosen.

Structure of Wheel

For soft, ductile materials, the open structure widths are recommended. The open structure permits the grains, which are widely separated, to penetrate deeper than close structure would, and it also allows sufficient room for the larger chips. Such a structure also decreases the likelihood of metal particles sticking to the wheel face. For grinding hard materials, it is desirable to have as many grain particles cutting as possible. Hard materials, resisting penetration of the grinding wheel grains, naturally cause smaller chips. Such denser structure (closer grain spacing) enables the presentation of the desired number of cutting grains to the workpiece. Therefore, select wheels of close structure when grinding harder materials. Wheels of this type will also produce a finer finish and retain their shapes better (e.g., the formed wheels).

Grinding action of the wheel can thus be controlled by the selection of the proper structure. With suitable structure, chips will either fall free of the wheel as they should in dry grinding operation, or they will be carried away by the coolant as in wet grinding. Soft, ductile metals present greater problems of chip disposal. They tend to stick to the wheel face and become embedded in it. Chips from hard metals on the other hand are more easily thrown away from the wheel and do not adhere as readily to the wheel face.

Area of Contact

Smaller contact areas have greater stresses, pressures, and destroying powers per square inch put on them. Therefore, the smaller the area, the harder the grade of the wheel should be in order to withstand the pressure and vice versa. Using closer grain spacing, that is, placing more grains per square inch against the workpiece, means that more grains will carry the same amount of compressive force. The result will be longer wheel life.

Other Factors Influencing Hardness

Wheel speed and work speed ratio can also assist in determining the selection.

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However, it is much more advantageous to accept the recommended wheel speed and select the right wheel by considering all other factors. The properly selected wheel is the one often called "self sharpening", that is, a wheel in which the abrasive particles are held by the bond only while they are sharp and cutting. If this is not the case, and the wheel is too hard, the abrasive particles will remain in the bond after they become dull and glaze the wheel or burn the workpiece. On the other hand, if the wheel is too soft, the abrasive particles will break out or be pulled from the bond before they have done all the cutting of which they are capable.

Wheel Dressing

Operators may be obliged to dress a coarse wheel for finish grinding when the proper wheel is not on hand to fit the job. A fine wheel may produce a coarse effect by traversing the diamond dressing tool across the wheel face rapidly. The coarsened wheel face will give more rapid material removal.

In job-shop techniques, operators occasionally will finish-grind with a wheel which has been selected for coarser work by dressing the wheel with a light infeed. A wheel face so dressed will remove material at a slower rate and produce a fine finished surface. Or, the speed of the workpiece may be lowered on the finishing cuts.

Changes in Infeed and Traverse

It is possible to increase the stresses on the wheel by increasing the infeed. This will make the wheel "act softer"; provided, of course, that the rigidity of the grinding machine will allow this. The opposite also is true, in which case the wheel will "act harder."

Increasing speed of traverse will make the wheel "act harder". The effect of these changes are particularly noticeable in cylindrical and internal grinding. If the wheel acts too soft, i.e., if the wheel bonds wear out before the grains wear out, shopmen often increase the wheel speed, or reduce the work speed. If the wheel acts too hard, try reducing the wheel-to-work ratio by decreasing the wheel speed. Thus more material will be removed in the same number of cuts per minute. This will result in increasing the depth of the grain cut.

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Nickel Conservation Research

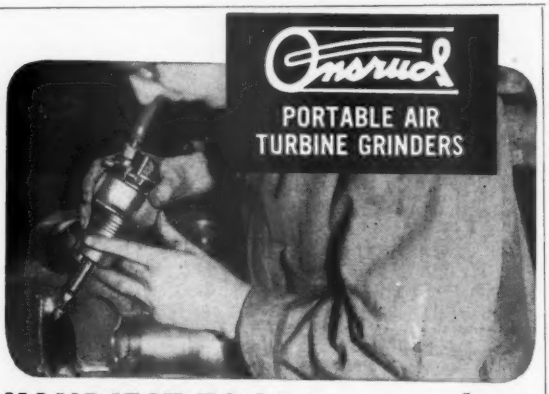
Conservation of vitally-needed nickel and chromium in heat resistant castings is the objective of important research just announced by the Alloy Casting Institute, of Mineola, New York. Conducted at the Battelle Memorial Institute, research has been concentrated on developing a heat resistant material of lower alloy content that the high nickel alloys frequently used in 900-1400 F service. From knowledge of the iron-chromium-nickel alloy system and field experience, casting metallurgists selected an alloy containing 21% chromium and 9% nickel, designated as the HF type, as the material most likely to provide the combination of strength and corrosion resistance required for "intermediate temperature" (900-1400F) service. Tests to date indicate that this alloy offers a promising solution to the requirements of such service.

Several years ago it was recognized that increased use of industrial processes operating in the 900-1400 F temperature range would create a demand for a somewhat lower alloyed material than the grades normally employed at higher temperatures. A limited alloy development study was authorized by the Alloy Casting Institute as part of the broad temperature research program sponsored at Battelle for many years by the national organization of high alloy foundries. But when the post Korea rearmament program rapidly brought about a shortage in the nickel supply, this added incentive caused the project to be given prime consideration, and intensive work was started in October 1950.

By June 1951 the nickel shortage became so acute that the National Production Authority started a program of "downgrading" alloys. This was formalized for heat resistant materials by order M-80, Schedule C, issued last December. The order places maximum limits on the nickel and nickel-chromium contents permitted for various temperature zones. For certain furnace parts and for oil refinery, synthetic rubber processing, cement mill and power boiler equipment in the intermediate temperature zone, the order limits maximum nickel content to 11%.

The Battelle research team, under the supervision of J. H. Jackson, is now investigating a series of 14 compositions within the HF alloy specification range, to

(Continued on page 136)



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Du Pont Started Scrap Drive 45 Years Ago

The Du Pont Company "mined" enough iron and steel scrap last year to make the steel for a 45,000-ton battle-ship, a naval aircraft carrier, 2,000 Sherman tanks, and 440,000 five-inch shells.

The scrap was rounded up by the company's salvage and reclamation program, begun in 1907 and pressed with redoubled intensity last year in response to the National Production Authority's plea for scrap metals critically needed for defense and essential civilian production. Du Pont's collection was channeled to outside companies and into re-use in its own operations.

From Du Pont plants and installations the drive in 1951 netted 132,371,000 pounds or more than 59,000 gross tons of all scrap metals, including iron, steel, iron-bearing sludge, lead, copper, aluminum, nickel, and zinc.

Iron and steel scrap totaled 56,250 gross tons, sufficient to provide the scrap content to forge, with hot melt steel from ore, all the steel for either three 45,000-ton battleships of the Iowa class, or four carriers of the Essex type, or 4,400 Sherman type tanks, or 2,835,000 five-inch shells.

In addition to the iron and steel, 4,000,000 pounds of lead, 1,800,000 pounds of copper, 76,000 pounds of aluminum, 61,000 pounds of nickel, and 34,000 pounds of zinc were salvaged in the Du Pont program.

The Salvage and Reclamation Division which administers the company's program is headed by Luther H. Broadway, manager. In addition to metals, normal operation of the program last year conserved hundreds of tons of economically useful wastes including paper, chemicals, greases, empty containers, pipe, valves, electrical and mill supplies, and hundreds of other products for conversion to further use.

By its salvage operations, Du Pont has demonstrated through the years that good "plant housekeeping" is essential to economy and safety. Material reclaimed is salvaged for re-use in the company's own operations or sold for defense projects and other uses outside the company.

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Nickel, from page 134

determine which compositions will offer optimum mechanical properties at elevated temperatures. If the present research on HF alloy continues favorable, then users should be able to substitute this grade in many intermediate temperature applications for materials containing from 30 to 100% more nickel, thereby freeing supplies of this vital element for higher temperature applications, where its use is indispensable.

The HF grade probably would have been investigated for this use a long time ago, except for the mistaken assumption that its properties in the 900-1400 F range are markedly inferior to the higher alloy materials now used. This incorrect idea doubtless arose from the fact that the wrought stainless steels containing about 18% chromium and 8% nickel, have considerably less high temperature strength than the cast alloys of the 25% chromium-12% nickel and the 35% nickel-15% chromium types. However, this is not true in cast alloys, since the latitude of compositions possible in cast alloys allows use of chemical ranges unsuited to wrought alloy production. Tests now being made indicate the cast HF material to have strength properties comparable to higher alloyed cast grades at these intermediate temperatures.

This development is a striking illustration of the fact that the same nominal composition in wrought and cast alloys does not mean that mechanical properties of each material are the same—frequently, they are quite different. This situation points up the necessity for using the ACI alloy designations in ordering castings, rather than the AISI type numbers) 302, 304, etc.) which are associated with wrought materials only.

★ ★ ★

DIE BLOCK AVAILABILITY

Part of the die block capacity of the plant at Eddystone, Pa., being reactivated for the U. S. Air Force by Heppenstall Co., Pittsburgh, may be available for other than Air Force uses.

R. B. Heppenstall, president, has advised: "We expect to ship die blocks from Eddystone by the end of June of this year. Our agreement with the Air Force permits us to manufacture die blocks at Eddystone for all of our customers so long as we have first satisfied the delivery requirements of the Air Force prime and sub-contractors. This means that all of our die block customers will benefit within a few months by our greatly increased capacity."

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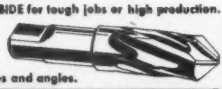

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. . . Tooling & Methods, from page 114

best conditions possible are required.

(10) Tool Storage: Servicing and storing of auxiliary tools should be as conveniently near as possible to the operator or machine where used. Every precaution should be taken in storage, as carbide cutting edges can very easily be damaged by improper handling. Tool replacement should be made as accessible to the operator as is possible for resetting and changes. It is advisable that an accurate record be kept of tool life and replacements.

As the type of tools recommended are inexpensive, or at least are available at about one-third the cost of ordinary tooling, sufficient supplies can be maintained and proper records kept.

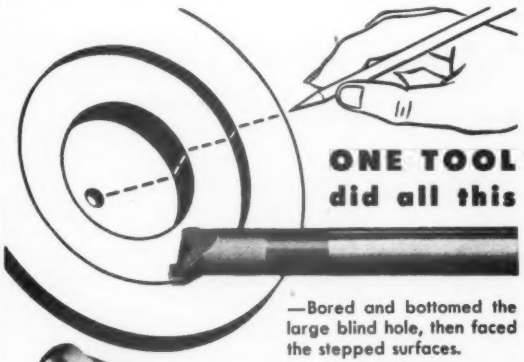
(11) Planning, Layout and Methods: These are outstandingly important, in that if a job is properly diagnosed as to speeds, feeds, stock removal, tool sequence, proper tooling and equipment, gaging, gearing, and caming, then and only then can we expect operators and shop personnel to function properly.

This group should be familiar with each and every tool's capacity in stock removal, and should know which, if any, are the tools to be favored, and how feeds and speeds shall be regulated accordingly.

Equipment and tools are capable of performing at a rate six times as great as has been achieved. If equipment is this efficient, then it must follow that the same amount of work can be produced on one-sixth of the machines now required. If each machine is worth twenty thousand dollars, how much can you reduce your machine inventory? Is it worth giving it a try? What if we are required to do things differently than has been our practice? It is well worth the try.

I can vouch for the fact that, where sixty automatics were required for production requirements, forty machines are doing more work today and if a complete change over had been realized, twenty more could be discarded. We probably never will reach the sublime, but if those machines should be replaced under the old conditions, eight hundred thousand dollars would be required, not to mention their upkeep and tooling.

Should we spend a few of these dollars on education for a better understanding of tools and machine performance or shall we be like the Orientals, going on for two thousand years as we are?



—Bored and bottomed the large blind hole, then faced the stepped surfaces.

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STYLE B
for bottoming and facing

STYLE C
for threading

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Packaging Overseas Shipments

The Wirebound Box Manufacturers Association is calling defense contractors' attention to the fact that MIL-B-107A specification for wirebound boxes for overseas shipment of defense goods has superseded and supplanted the old JAN-B-107 specification.

Purchasing agents, packing engineers, and shipping executives are being cautioned that JAN-B-107 wirebound shipping containers for overseas shipment are no longer in keeping with government requirements, regardless of the wording of government contracts or bid invitations.

The Associations headquarters in Chicago pointed out that some government procurement officers throughout the country continue to stipulate JAN-B-107 boxes, apparently not yet aware that the new MIL-B-107A specifications became effective last September 1 and replaced the older specification.

L. S. Beale, secretary of the association, pointed out that government invitations to bid on defense commodities almost invariably contain this statement:

"The following specifications, one of the issue in effect on the date of invitation for bids, form a part of this specification."

Thus, Beale said, those bidding for contracts that stipulate wirebound boxes for overseas packing made in accordance with the JAN-B-107 specification should compute their packing costs upon the basis of wirebound boxes made in accordance with the MIL-B-107A specification, being the "issue in effect".

The MIL-B-107A specification leaves the construction of some sizes or types of wirebound boxes parctically unchanged from what they were under the JAN-B-107 specification, but result in many others being constructed more strongly than before and even better able to absorb the hard usage encountered in export shipment.

"So many new and revised specifications in so many different fields are constantly being issued by the government," Beale explained, "that it is understandably difficult for every government procurement officer to have 100 percent knowledge of all such changes. It is incumbent, however, for contractors to know precisely all the specifications they are bidding on and that govern in each case. Therefore, even though something is made or packed in good faith in accordance with an out-moded specification mentioned or stipulated in an invitation to bid or in a government contract itself, a government inspector along the line may reject the whole lot for its failure to be in accordance with governing specifications."

Manufacturers of wirebound shipping containers, Beale said, are individually also striving to correct misunderstandings on the part of government contractors concerning specifications governing containers, including those for wirebound boxes for overseas shipment.

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. . . Friction Sawing, from page 122

increases. The variation in softening is therefore met by adjustment of the saw velocity. The usual friction sawing velocity range is from 6000 to 12000 fpm. Velocities of 14000 fpm are often recommended, but only in such cases should they be attempted. Generally speaking, 12000 fpm is regarded as a maximum. This does not exclude the fact that one may well increase a given velocity by even 1000 fpm to suit individual conditions and this course might well prove very effective.

Friction Sawing as Applied to Tubing

Interest has developed in cutting pipe or tubing by this process because the time per cut is comparatively much less than by any other method. Here again there are certain limitations in regard to wall thickness in relation to outside diameters of tubing. In this applications of friction sawing maximum work thickness is approached momentarily by the saw and is reached only as it breaks through the inner wall, whereas with flat stock the thickness remains unchanged. For friction sawing to be practical it is imperative to establish a maximum wall thickness per a given diameter. However, with proper means to hold the tubing and with the use of hydraulic feed, greater wall thicknesses than recommended in accompanying chart may be cut satisfactorily.

★ ★ ★

Certificate of Cooperation Awarded Gray Iron Founder's Society

For furnishing technical assistance to the peoples of the Marshall Plan countries, the Gray Iron Founders' Society, national trade association for the gray iron foundry industry, was awarded a Certificate of Cooperation from the Economic Cooperation Administration.

The special recognition was given to the Society for the role it has played in supporting Mutual American European efforts to strengthen the free nations against communism.

Since 1949, the Economic Cooperation Administration, predecessor to the new Mutual Security Agency, has been bringing groups of European technicians and specialists to this country to see how our American factories use modern techniques for efficient production.

The Gray Iron Founders' Society is presently assisting a delegation of foundrymen from Portugal. This group arrived in the United States on April 2, 1952.

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Free Cutting Copper, from page 63

commercial applications of this has been made to the author's knowledge. It has also been stated [1] that small quantities of iron and nickel appear to have a favorable effect on the machining properties of bronzes, but the mechanism is not completely understood. Where these elements are increased in precentage figures, both the hardness and strength increases accompanied by impaired machinability [1].

The Brown & Sharpe single spindle automatic machines have proven to be quite versatile in the machining of small parts; a representative group of machined parts made from the free cutting copper base alloys being illustrated in Figures 3 to 6. The older types of Brown & Sharpe automatics at LF&C are overhead driven, while the more recent models purchased are motor driven. The general principles of this type of automatic screw machine are quite simple. A bar of stock is held firmly in the spindle by a spring collet and rotated. Two pulleys on the spindle are driven by belt either from a countershaft or a driving motor. These pulleys run free and either one or the other is engaged to drive the spindle by means of a friction clutch between the pulleys. This gives a spindle drive that allows the speed or direction of rotation to be changed or reversed.

The turret has six tool positions and is automatically indexed to bring each tool in position to perform specific cutting operations. At right angles to the spindle are the cross slides, functioning independently and permitting the overlapping of cutting operations. Both the turret and cross slide positions are moved to and from the work by special cams designed to give the proper feed to each tool.

Very little difficulty is experienced in the machining of the copper base alloys containing a free-machining element with tool life very satisfactory in comparison to the machining of other types of material. We have also found that in most instances the choice of lubricant is rather broad and, in many instances, an inexpensive lubricant can often be employed. Where trouble has been encountered in the past, the difficulty has usually been traced to operational procedures within the mill submitting the material. As per example, on one occasion considerable wear had been experienced on a circular form tool whereas all of the other tools within the set-up had been satisfactory as far as life between re-grinds had been concerned. An investigation of this problem revealed that the bars submitted had a tenacious oxide film present on the surface which for some reason or other had been inadequately removed prior to shipment. Fortunately, such difficulty occurs rather infrequently.

As in most shops, the most popular leaded copper base alloy is the free-cutting yellow brass composition, however considerable work has been done utilizing both the 12 and 18 percent leaded nickel silver alloys; this material having a machinability of approximately 50 percent of that exhibited by the free cutting yellow brass alloy. Other alloys that are used upon occasions is both the leaded commercial

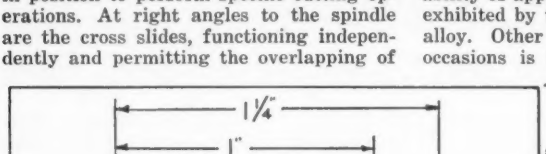


FIG. 3

Fig. 3:
Machine: Brown & Sharpe
Material: Free Cutting Yellow Brass
Analysis

Copper	62.0%
Zinc	35.0%
Lead	3.0%

Operational Procedures

1. Stop
2. Spot
3. Drill
4. Finish Drill
5. Counterbore
   Form (front slide)
   Cut Off (back slide)

bronzes and the leaded red brass compositions. The choice of free-cutting yellow brass, in many instances, is governed not only to its excellent machinability but also to the fact that it is relatively low in cost. Other features that may govern the choice of this specific composition is low power requirements, long tool life expectancy and excellent surface finishes. Both the leaded commercial bronze and the leaded naval brass alloys are usually chosen for their corrosion resistance; the former alloy mentioned having excellent color characteristics. The choice of the nickel silver compositions is usually on the basis of their color characteristics, however these alloys have also good corrosion resistance.

In the use of the Brown and Sharpe automatics, the basic factors to consider in planning a job would include speeds, feeds, choice of tools, overlapping of primary operations and the use of attachments. Although these factors may have values of varying proportions in individual shops, each should be considered in relationship with both the material chosen, shape and size of part, and machine type. The usual guide to follow in planning of work is that based on experience gained in the machining of similar jobs or similar materials. In other cases, the many guide books published by the mill can serve as a starting point and deviation either one way or the other can be made in accordance to the specific requirements of the job.

Preliminary to the discussion of the above factors mentioned, it may be wise to discuss the classification which most mills recognize; this classification arbitrarily placing the various copper base alloys within a group and subsequent recommendations that are given is effective for those alloys within the group mentioned. Thus, most of the alloys within the free-cutting classification is within Group 1; these alloys having a machinability rating of 70 percent or more. In Group 2, as illustrated in Table II, there are a few alloys that have a machinability rating of less than 70 percent. This tabulation is not quite complete since it is confined to those alloys that have a free machining element present within the composition.

Table II

Suggested Division of the Free Cutting Copper Base Alloys

Group 1 Alloys	Rating
Free Cutting Yellow Brass	100
Architectural Bronze	90
High Leaded Brass	90
Tellurium Copper	90
Forging Brass	80
Leaded Red Brass	90
Leaded Copper	80
Leaded Naval Brass	80
Extruded Leaded Nickel Silver, 10%	80
Group 2 Alloys	
Leaded Phosphor Bronze, 5%	50
Leaded Nickel Silver, 12%	50
Leaded Nickel Silver, 18%	50
Leaded Silicon Copper, 3%	60

The speed of the machine is determined by both the material to be machined and the type of operation involved. When several operations requiring different speeds are necessary in the same set-up, only one can be performed at the optimum speed unless a number of spindle speeds are available. Although changing of speeds entails idle time, this can be compensated where two or more operations can be performed simultaneously, even though the machining speed employed is the highest possible for only one of the operations. Usually those tools which perform external operations such as forming, turning, cut-off, etc. can employ the higher speeds as per contrast to those internal operations such as drilling, tapping, etc. which must necessarily be run at lower speeds. One advantage that the modern Brown & Sharpe automatics have over the older type machine is the number of speed combinations available.

On most copper base alloys, it is generally good practice to use the highest practical speed, a relatively light feed and moderate depth of cut. The choice of the above factors, as we have determined, will be dependent upon those variables such as type of operation or combination of operations to be performed within each cycle; the size of tool necessary to perform these operations; the tool composition; the finish required on the finished part; and the accuracy that is demanded. Thus, on each individual problem it may be necessary to perform experimental runs; this

(Continued on page 144)

Pull-Down Broaching Machine Produces Large Tapered Splines

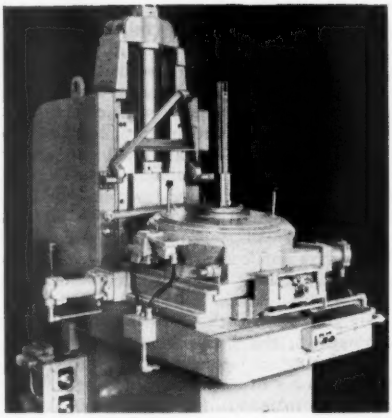
Use of the broaching process in the production of accurate tapered splines on several different sizes of parts is possible with a broaching machine developed by Colonial Broach Company.

The broaching machine basically is a Colonial 15-ton, 66-in. stroke pull-down model equipped with a special table and an adjustable short shuttle travel.

The machine illustrated in Figure 1 is designed to produce several sizes of angular straight-sided splines in tractor sprocket wheels, etc. of varying OD's. The tractor wheel is placed over the broach tower on a fixture plate with the broach in the 'down' position. The angle of the plate is made so that the broach, which travels vertically, will produce splines with the correct amount of taper. The parts are held in position with hold-down studs and a strap clamp.

When the part is clamped in position, the 'start' button is pressed and the machine starts an automatic operating cycle. The broach travels down, the table recedes, the fixture indexes to position for the next spline and the cycle repeats. When all splines have been produced, the machine stops for unloading.

Operation is hydraulic throughout with electrical controls. A hinged arm on the machine column is swung into position by a manually controlled hydraulic cylinder after the part is loaded into place. This arm backs up the broach guide during the cut and thus avoids broach deflection.



Cutting time for the broaching operation is kept to a minimum, and maximum rigidity of fixture mounting assured by the small amount of shuttle movement. On the tractor wheel, the maximum shuttle movement is ⅜ in. Some sizes of splines in the hubs permit shuttle movement to be adjusted to 3/16 inch.

The largest part broached on the machine has a 42 in. OD. Concentricity of splines with the outside diameter of the parts is achieved by fitting the OD into a ground hole in the fixture plate. Fixture plates are interchanged to suit the various parts.

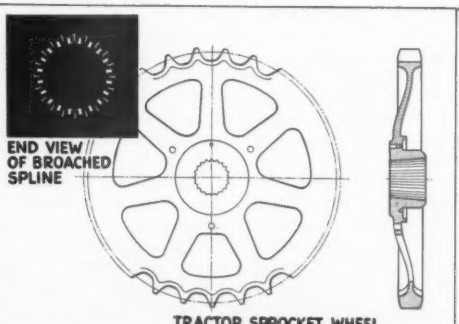
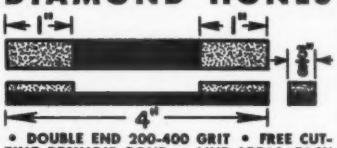


Fig. 1. Shown above is a Colonial pull-down broaching machine designed to produce large tapered splines in a variety of parts. Note the broach backup arm that is swung back to permit loading of parts.

★

Fig. 2 at left, shows a line drawing of tractor sprocket wheels with an inset showing end view of tapered spline produced by the broaching operation.

DIAMOND HONES



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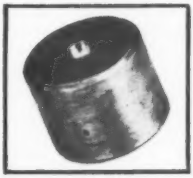

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. . . Free Cutting Copper, from page 141

being especially true if the problem is beyond the usual practices that have been performed in the past. The feeds used in operational machining will vary, thus in drilling operations, the feed may vary from 0.002 to as high as 0.020 inches on Group 1 alloys depending upon both the diameter of the drilled hole and the depth to which it is drilled. In box tool work with roller rests, the feed normally employed may vary from 0.006 to 0.012 inches depending upon the depth of cut and whether it is a roughing or finishing operation. Recommended feeds of the more frequently used operations are tabulated; these values serving as a basis in the determination of the specific values to be employed.

Discussion of tooling utilizing the Brown & Sharpe automatics in the machining of the free-cutting copper base alloys will be confined to the more frequently used operations such as illustrated by (1) the box tool, the balanced turning tool and the hollow mills which are employed in turret positions for turning down diameters; (2) the circular forming tool and the circular cut-off tool which operates from the cross slide positions; and, (3) such tooling utilizing turret positions such as drilling, reaming, threading and counterboring.

Both the hollow mills and the balanced turning tool is used to a large extent for roughing operations; the former mentioned type of tool being subdivided into the straight and the adjustable hollow mills. The roughing tool which is used to a greater extent is the balanced turning tool; this choice being on the basis of its adjustability over a wide range of diameters and the comparative ease experienced in grinding and setting the square blades. Where long, slender pieces are to be roughed, the hollow mills are the preferred since the center hole within the mill can offer additional support to the work.

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2. 'Machinability of Copper Alloys', D. K. Crampton, Metal Progress, Vol. 46, Aug. 1944, p 275.
3. 'Copper Alloys containing Sulfur, Selenium and Tellurium', C. S. Smith, Trans. A.I.M.E., Vol. 128, 1938, p 325.
4. 'Effect of Tellurium on Copper Base Alloys', H. L. Burghoff and D. E. Lawson, Trans. A.I.M.E., Vol. 128, p 315.
5. 'Free Cutting Brass, Bronze and Copper', Chase Brass and Copper Co., Waterbury, Conn.
6. 'How to get Maximum Production from Single Spindle Automatics', W. E. Rollins, Machinery, April 1951, p. 166.
7. 'How to Machine Copper Alloys', Lester F. Spencer, American Machinist, Oct. 29, 1951, pp 109-123.
8. 'Machining Copper and Copper Base Alloys', The American Brass Co., Waterbury, Conn.

In the turning of the free-cutting copper base alloys, the tops of the faces of the teeth on both the hollow mill and the balanced turning tool should be parallel to the center line of the tool in order to avoid 'hogging in'. The cutting edges are parallel to the radii and they should be ahead of or above center by 0.010 to 0.015 inches.

(To Be Continued)

★ ★ ★

Color and Sound Film Tells Chuckling Story

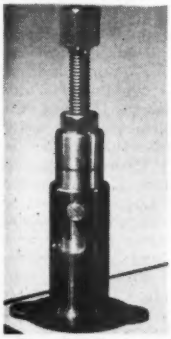
A new educational color movie titled, "Chucks and Their Uses", has just been released by The Skinner Chuck Co., New Britain, Conn. This is a 16 m/m, Kodachrome, sound film on a single 1200 foot reel, with a running time of 30 minutes.

This new film is of equal interest to apprentices and machine operators, as well as engineers and production men. Various scenes include a complete showing of parts, construction, mounting and use of independent, universal scroll and power chucks; a fascinating study of stresses and strains using a 10" plastic chuck photographed under polarized light; spindle noses and mounting; tests for runout and balance; a full scene on the horsepower requirements of modern machine tools; the design and application of machine vises.

"Chucks and their Uses" is available for showing without charge to qualified schools, engineering groups, etc.

New Depth Gage Boon To Diemakers & Diesetters

The recently announced Ke-Vo Die Depth Gage is designed to accurately set the depth to which punch or punches may enter the die, and to assure that they will enter to the same depth each time the die is set in a press.



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Advantages of depth gage include reduced die setting time, greater die protection and die life, and reduction of scrapped work when setting, forming and drawing dies.

★

The depth gage is mounted on the die shoe at the time the die is made. It is adjusted to its required height at the time of die tryout. Then, when die is set on a production press, the ram is jogged down until the upper shoe or punchholder contacts the gage. Stops are then set.

A major time element in diesetting is thereby practically eliminated. The effective shut height is determined once, at time of die tryout; thereafter, the diesetter merely adjusts the ram to the gage. The gage screw and locating barrel can be depressed against spring pressure and locked out of the way when press is producing parts.

For initial setting of the gage (in fully closed position when starting), the diesetter brings the ram with punch mounted in place to the bottom of its stroke, loosens the locknut on the gage screw, turns the screw up until it contacts the upper shoe, and then tightens the locknut. This setting need not be changed until the die is returned for regrind. At that time the gage height is reduced by an amount equal to the grind stock removed from punch and die faces.

Further information may be obtained by writing to **VOCAR MANUFACTURING & SALES, Box 97, Prospect Heights, Illinois, or Circle Inform-A-Gram No. D1.**

. . . Machinability, from page 119

practice in the jet engine industry today. Standardization of single-point cutting tools has been established along with the most desirable tool design for most of the alloys being used.

The Meyer exponent, which is established from a series of concentric Brinell impressions, is generally used in the machine tool industry as a measure of the work hardening characteristics of materials.

Because the majority of these alloys exhibit a marked tendency to work-hardening, tools must always be rigidly supported and must have keen cutting edges. The Meyer exponent for several high temperature alloys is shown in Figure 4.

Many jobs have been overcome by changing rake angles on a tool. In general the higher the Meyer exponent, the greater must be the clearance angles. Not only does a tool have to be designed to do the job called out by the print, but it has to be designed for the material.

To prevent excessive tool wear and reduce the contact of the chip with the tool, intelligent use of a chip breaker is of extreme value in machining these alloys—particularly in turning, drilling, and broaching.

(To be continued)

★ ★ ★

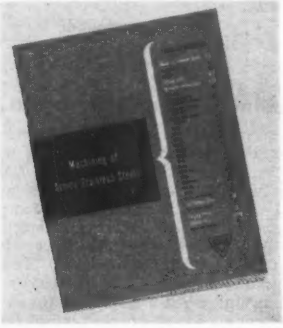
What's the Difference?

A new, full-color sound 16mm motion picture, "What's the difference?", has just been released by Jones & Lamson Machine Company. With a 21 minute running time, this film tells the full optical comparator inspection story—from "comparison" to "precision measurement"—with production line scenes taken in other plants under working conditions. "This medium", according to J&L, "finally brings to the viewer, actual moving shadow images heretofore not possible—short of seeing the comparator itself." Qualified bookings for the loan of this movie are now being made; for schools, technical associations, manufacturers, quality control groups, and similar showings. This new film is the latest addition to the J&L movie loan-library which includes motion pix on Turret Lathes and precision thread grinding. Also available is a comparator silent slide film of about 90 frames. Write Dept. 710M, Jones & Lamson Machine Company, Springfield, Vermont.

Circle postage-free Inform-A-Gram Key Number for your request.

Datair File of Pneumatic Cylinder Application Data Sheets presents operation and installation data, list of devices required, and savings obtained on a selection of representative shop applications of pneumatic controls. Included are examples of use of air-powered cylinders and related controls for piercing and forming operations, for light assembly work, for high speed and high impact shredding operation, and others. This data file is available from WESTINGHOUSE AIR BRAKE CO., Wilmerding, Pa.
Circle Inform-A-Gram No. C1.

"Machining of Armco Stainless Steels," in its newly revised 40-page edition, contains an improved section descriptive of the various Armco stainless types, with machining characteristics of each. A master table of cutting speeds for various operations on the different steels, when using a specific tool material, will be especially helpful. Detailed operating instructions — tool materials, grinding details, speeds, feeds, work holding, etc.—are given for more than 20 different types of machining. Also included are



charts for selection of tool materials and coolants, conversion tables, and tables of standard sizes and tolerances for Armco bars and wire. Special attention has been given to the requirements for high production of stainless steel parts on automatic screw machines—both heavy duty and Swiss types. This valuable manual may be obtained from ARMCO STEEL CORPORATION, Middletown, Ohio.
Circle Inform-A-Gram No. C2.

Helpful 20-page Spark Test Guide features individual spark diagrams of 13 standard tool and die steels. These are supplemented by detailed description of the spark characteristics of each steel. General recommendations for dressing the grinding wheel, preparing the steel sample, and making of the test are also given. Spark testing when the grade of steel is in question will often save the toolmaker or diemaker many hours of labor, will ensure use of proper steel. THE CARPENTER STEEL CO., 306 West Bern St., Reading, Pa.
Circle Inform-A-Gram No. C3.

"Materials Handling Analysis Guide", a 16-page booklet, was prepared specifically to assist those plants where no staff materials handling engineer is employed. By answering 28 simple questions, the busy executive reveals to himself a graphic picture of his current situation and requirements. AUTOMATIC TRANSPORTATION CO., 149 W. 87th St., Chicago 20.
Circle Inform-A-Gram No. C4.

Ward Calculator for Determining Piercing Pressures required to punch a given size hole in any thickness and type of metal is offered to all shops doing stamping work. By simply shifting the sliding scale, aligning known factors, the pressure in tons for any hole ranging from 3/16" to 10" dia. and .5" to 30" perimeter is quickly and accurately located. For this calculator, and a copy of Punch and Die Catalog

No. 152A, write WARD MACHINERY CO., 564 W. Washington Blvd., Chicago 6.
Circle Inform-A-Gram No. C5.

PROSSER CARBIDE TOOL GRINDERS SAVE TIME — SAVE MONEY!

Prosser grinders are outstanding for speed, accuracy, thrift and are available in a wide range. Famous Prosser indexing device permits instant, accurate angle setting that "stays put". Easy adjustment permits virtually 100% use of wheels. For grinding carbide, high speed steel, stellite and other modern tools, with any combination of diamond, silicon carbide or aluminum oxide wheels. Wet or dry models.

Designed by Prosser — originator of cemented carbide for American industry — these efficient grinders are ruggedly constructed to serve you dependably for years.

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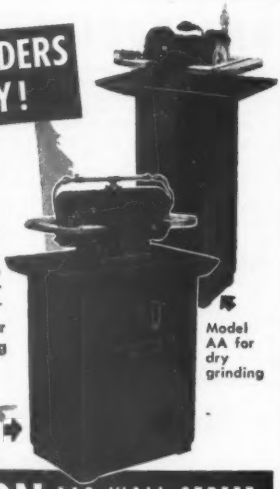

Model AA for dry grinding

Model [illegible] for wet or dry grinding

THOMAS PROSSER & SON 118 WALL STREET, NEW YORK 5, N. Y.

441 STANDARD SIZES OF MARSHALL STEEL PRECISION GROUND FLAT STOCK

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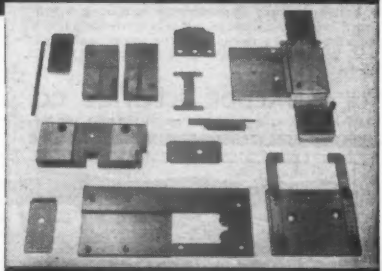
AIRcrat: This air-hardening tool steel shows less size change and offers a greater safety in hardening than either of the other grades. Box 188, Dept. TD

Write for descriptive literature, catalog of sizes and prices.



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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

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Roto-Master Hi-Speed grinder makes carbide roughing and finishing available to every shop. Designed for operations requiring precise "finger-tip" control, in conjunction with carbide burrs and mounted wheels from 1/16" to ¼" dia.

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Baldor

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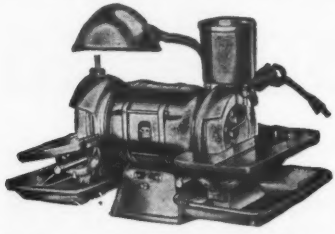

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Yoder Slitting Book will be of considerable value to those stamping plants who are considering the setting up of their own slitting lines for the production of narrow and special width coil stock from regular mill runs of maximum width stock. Although many machines and accessories are listed, this book is more of a manual than catalog. Standardization, time studies, coil handling, comparison of power shears with rotary slitters, scrap disposal, floor layout, and scrap disposal all come in for discussion. Various machines, recoilers, scrap winders, and others are described. THE YODER COMPANY, 5500 Walworth Ave., Cleveland 2.
Circle Inform-A-Gram No. C6.

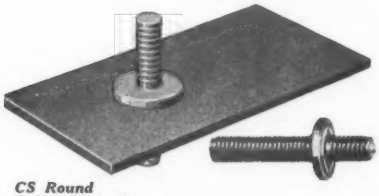
"Pocket Book on Fabricating C-D Plastics" is a valuable 64-page manual on how to save time in fabricating laminates, fibre, mica, fabric-based plastics. Detailed tool, speed, feed, work handling and holding recommendations, cold and hot working data, are given for machining, punching, shearing, forming, drawing, and finishing operations commonly performed on these non-metallics. Fabrication data is related to ordering economies. CONTINENTAL DIAMOND FIBRE CO., Newark, Dela.
Circle Inform-A-Gram No. C7.

"Riveting with Hi-Shears" is a new 56-page pocket manual, written especially for shop riveters and inspectors. Simplified drawings and non-technical language contribute to its ease of reading and its general value. This booklet tells where and why Hi-Shear rivets are used, how specifications are determined, and how they are installed. Complete recommendations are included on hole preparation; riveting methods and technique; riveting with riveters, hand tools, and punch presses; methods for rivet removal; inspection, identification, and trouble shooting. THE HI-SHEAR RIVET TOOL CO., 8924 Bellanca Ave., Los Angeles 45.
Circle Inform-A-Gram No. C8.

"Barrel-Finishing with Alundum Tumbling Abrasive" is another of Norton's famous line of pocket manuals. This 55-page booklet summarizes the composition and characteristics of Alundum tumbling abrasive, available grit sizes, operating conditions and requirements, equipment, and cleaners. The various steps for barrel finishing of mass produced parts are outlined. A section devoted to practical hints for operators covers screening, degreasing, etc. For your copy, write to NORTON COMPANY, Worcester 6, Mass.
Circle Inform-A-Gram No. C9.

Precision Investment Casting by the Microcast process is described graphically in beautiful 16-page booklet, "New Opportunities for the Creative Product and Design Engineer". In clear concise steps and with full-color pictures, the process is explained. Tables show various alloys used and their physical properties. Included are examples of dimensional tolerances on complicated parts, range of structural shapes, and principal design characteristics. Microcast Div'n, AUSTENAL LABORATORIES, INC., 7001 S. Chicago Ave., Chicago 37.
Circle Inform-A-Gram No. C10.

USE RESISTANCE WELDING TO STREAMLINE PRODUCTION



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Material Low Carbon Steel

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THE OHIO NUT & BOLT COMPANY
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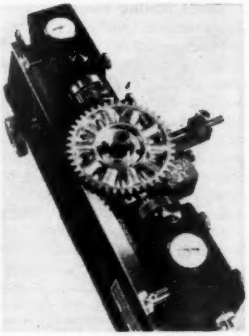
Helix Angles On Gear Teeth Are Now Checked Quickly and Accurately

An adaptor and an attachment recently developed for the Orlandi Gear Checker—a product of Orlandi Gear and Machine Company — have greatly increased the value of this instrument as an aid to improving gear quality and reducing scrap.

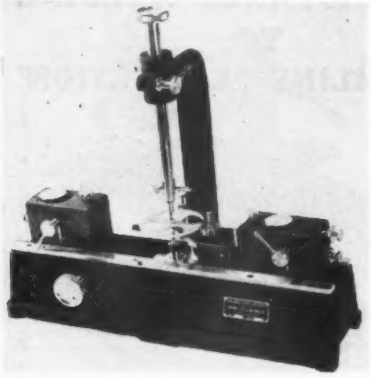
The new adaptor simplifies the set-up for checking helix angles. The size gage block required for set-up is determined by simply taking the sine of the helix from a trig table, subtracting ½ the diameter of the adaptor pin, and adding the net result to the "constant".

A new rolling attachment for use with a master gear makes possible the rapid checking of pitch diameter and concentricity to within .0001" accuracy. With this attachment, backlash can also be checked with mating gears or master gears.



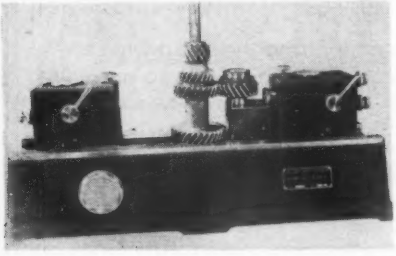
Development of New Adaptor Extends Range of Versatile Orlandi Gear Checker to the Production Checking of Helix Angles

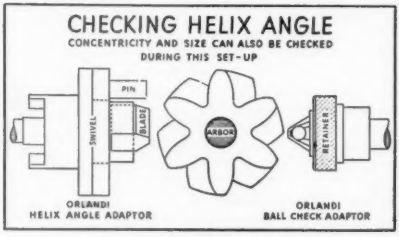
These new uses for the Gear Checker are additional to those already offered by the basic machine and standard attachments, including the checking of parallelism, pitch diameter, tooth spacing, backlash, root diameter, and accumulated error at 90° and 180°.



Set-up demonstrating use of rolling attachment in making fast production gear check. A secondary attachment is here used to assure gear alignment.

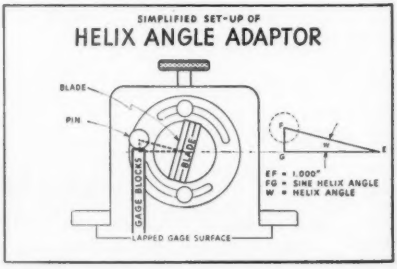
Another set-up with rolling attachment being used for checking backlash of gears.





Diagrammatic sketch demonstrating use of the adaptor in making a helix check. Also shown is a ball adaptor for checking backlash, etc.

Diagrammatic sketch illustrating the simple and rapid method of computing and setting the adaptor for production helix check.



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Single pole momentary action switch, normally open.

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Socket for plugging into any 110 AC outlet.

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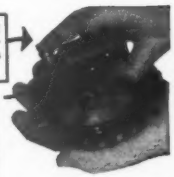

No. 100	Magnetic base Holder for smaller test indicators.	$7.50
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Dept. TP, 1101 West Monroe Street, Chicago 7

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

PUBLICATION

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Improved Live Center features tapered precision roller bearings, properly aligned by unique end plate having accessible adjusting screw. Changing of inserts is fast and simple, even without removing center from the machine. Adjustment for wear can be made in less than one-minute. Folder is available from ARROW TOOL & REAMER CO., 418-422 Livernois Ave., Detroit 9.
Circle Inform-A-Gram No. B1.

Strong, Rigid Punches of the fixed head type permit precision piercing, longer tool life, burr-free holes; can be securely keyed for accurate punching of irregular shaped holes; and often eliminate the necessity for hardened backing plates. Send for Catalog 102, describing 3-P line of punches, retainers, and button dies. PORTER PRECISION PRODUCTS, Cincinnati 31, Ohio.
Circle Inform-A-Gram No. B2.

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FOR FIXTURE CLAMPS
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High Speed Screw Production, without loss of extreme accuracy even at max. spindle speed of 10,000 rpm, is offered by Peterman P7 Automatic. Standard headstock spindle handles stock up to 9/32" dia. and holds work rigidly without bush where workpiece is short and of sufficient dia. to withstand cutting pressures. On long lengths, small dia. work, and where greater precision is demanded, a choice of several standard bushes provides the optimum combination of flexibility, ease of setup, and accuracy required for a particular class of work. The 16-page bulletin illustrates the many exceptional features of the precision headstock spindle, work holding methods, threading and drilling attachments (13,000 rpm max.), and other details and accessories. Bulletin 42E/4 is available from RUSSELL, HOLBROOK & HENDERSON, INC., 292 Madison Ave., New York 17.
Circle Inform-A-Gram No. B3.

High-Quality, Low-Cost Hole Finishes are obtained by ballizing process, which consists of pressing a hard-alloy precision ball through the unfinished hole. Hole size is readily held to plus-or-minus .0002". with the burnished surface being practically free of roughness and fine waviness irregularities. Surfaces obtained by this method are more premanent than other commonly-used methods. Technical Bulletin outlines the production advantages, cost advantages and limitations of ballizing, and describes the mechanics of the process as regards size control and work-hardening effect. Typical setups are illustrated. Bulletin is available from INDUSTRIAL TECTONICS, INC., 3684 Jackson Rd., Ann Arbor, Mich.
Circle Inform-A-Gram No. B4.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

Fast, Accurate Second Operation work is performed by hand screw machine, Model 5 having ¾" collet capacity and Model 7 having 1" capacity. Both models have variable spindle speeds up to 3300 rpm. Rotating parts are Dynetrically balanced for freedom from vibration at all speeds, thus permitting effective use of carbide and diamond tools. Bulletin, which describes the many exceptional features of this precision machine, is available from THE WADE TOOL COMPANY, 49 River St., Waltham 54, Mass.
Circle Inform-A-Gram No. B5.

Full Automatic Adjustment for stock variations is a feature of the Hall collet chuck, a push-out type for use on threaded spindle lathes and grinders. Bulletin describes construction and operation, emphasizes extra rigidity and positive gripping under high speeds and high cutting pressures. Chucks permit work reset without stopping lathe. For descriptive bulletin HCC-4, write to HALL MANUFACTURING CO., 622 Tularosa Dr., Los Angeles 26, Cal.
Circle Inform-A-Gram No. B6.

Freedom from Chips Without Loss of Visibility is provided by transparent shields, held by powerful magnetic grip to any ferrous surface on machine or bench, or fixture. Alnico permanent magnet hold guard securely in any position. Plastic panels can be quickly changed on magnetic base when desirable. They make unnecessary improvised shields which obscure operator's vision, collect chips and grime, and contribute to lost efficiency and faulty work. For bulletin write THE DILLEY MANUFACTURING CO., 1656 Ansel Rd., Cleveland 6, Ohio.
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Milling Cutters in Multiple Setups are quickly spaced to micrometer precision, using adjustable spacing collars, which are calibrated in increments of .001". Visual calibration readily permits adjustment to .00025". Although easily and quickly adjusted, collar provides positive locking. Write to DAYTON ROGERS MFG CO., Minneapolis 7, Minn. for descriptive literature.
Circle Inform-A-Gram No. B8.

Versatile Lathe Tool Holder swivels around in an entire circle, yet gives a perfect grip on either square tool bits or round boring bars. Thus it may be set for straight, right or left hand offset position. No lateral motion is possible. New catalog sheet lists four sizes, providing a tool bit capacity ranging from ⅛" to 7/16". THE WALTON CO., P. O. Box 5, Elmwood, Hartford 10, Conn.
Circle Inform-A-Gram No. B9.

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1912 - 1952
Over this long period we have helped many large and small metal working plants control cutting tool costs through efficient salvaging programs.
Regrinding and rebuilding of HSS and carbide tools.
We manufacture carbide drills and center drills for cutting hardened steel.
Representatives in all industrial areas.
National TOOL SALVAGE CO.
6511 Epworth Detroit 10, Mich.

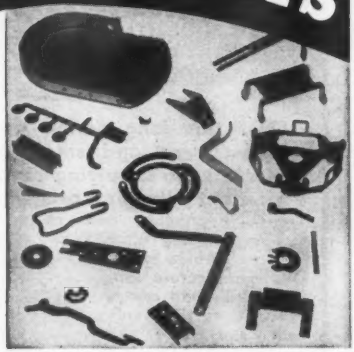
SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Many Conventional Heavy Machine Tools can be used practicably for a much wider range of work, by employing the heavy duty Type 4 "All-Angle" milling attachment having both direct drive (6 speeds) and back gearing (2 speeds). Although the largest unit of its type available, this attachment is a high-precision tool that permits working at any angle without changing the work setup . . . ideal for "difficult milling, drilling, boring, and grinding operations. For literature, write to the FRAY MACHINE TOOL CO., 515 W. Windsor, Glendale 4, Cal.
Circle Inform-A-Gram No. B10.

Precision Static Balancing in production of diversified rotating products is purpose of Micro-Poise machines used in conjunction with a correction unit such as drill press, welder, or milling attachment. Machines —available in 15 standard models — are calibrated and adapted to specific part requirements, need only minimum maintenance, feature 6 to 10 sec. balancing cycle. Line includes conveyorized, air-operated machines for high continuous production. Literature available from MICRO-POISE ENGINEERING & SALES CO., 14851 Grand River, Detroit 27.
Circle Inform-A-Gram No. B11.

DIE CUT PARTS

WLS SPEEDTOOLING Gives You PRECISION STAMPINGS for a Tool Charge as Low as 1/10 the Cost of Ordinary Dies



Our Specialty: Small Irregular Shaped Parts Stamped, Formed, Pierced, Extruded, Stencilled, Tapped, Countersunk.

For detailed information, send for literature. For firm quotations and delivery commitments, send us your prints.

WLS STAMPING COMPANY
Short Run Stampings

3290 East 80th Street Cleveland 4, Ohio

Write Us Today!

SHORT RUN STAMPINGS

Closely Controlled Pitch Tolerances and extreme concentricity are advantages of Salvo thread rolling and oil grooving attachments for all automatic screw machines. Units operate in sequence with present tool cycle of the machine selected, with no loss of alignment through rechucking the workpiece for separate operations. Units available for any class or size work. Thread rolling attachments and hydraulic control units are also available for turret and engine lathes, and for Bullard Mult-Au-Matics. For descriptive bulletin, write SALVO TOOL & ENGINEERING CO., 26441 Gratiot Ave., Roseville, Mich.
Circle Inform-A-Gram No. B12.

Complete Line of End Mills and Die Sinking Cutters is offered in new Catalog No. 23. These rotary tools, processed from selected high speed steels and carefully heat treated to provide maximum life at minimum cost, include single and double end types, small and large diameters, 2 or 3 or 4 flutes, straight or spiral flute, and straight or ball end. METAL REMOVAL CO., 1546 N. Orleans St., Chicago.
Circle Inform-A-Gram No. B13.

Sharp Image Definition with glare-free accuracy, is feature of new "Century" Optical Comparator. Illustrated circular describes many construction and operating features, which combine to provide a versatility and new high standard of inspection accuracy. A horizontal swing-away stage holds most work without need of special fixtures, permits change of lens units without disturbing set-ups, and provides helix angle positioning. Seven magnifications are standard lens units, mirror adjustments have been eliminated, chassis construction assures permanent alignment of optical system. Circular on Model "C-100" can be obtained from PORTMAN INSTRUMENT COMPANY, 6 Manhasset Ave., Port Washington, N. Y.
Circle Inform-A-Gram No. B14.

New Fastening Principle is announced in bulletin describing the "Spirol" pin, a machine pin formed by rolling strip steel spirally. The coiled spring nature of this pin enables it to assume the shape of any hole, fit snugly along entire length of hole, permanently lock in place without damage to hole walls, absorb shock, and resist vibration. These pins eliminate the need for any reaming, tapered holes, shrinking or press equipment. They are inserted by finger pressure or driven, depending upon tension required, are easy to remove and can be re-used. They are ideal for fastening dissimilar or fragile materials. Sizes presently available to fit all holes drilled from 1/16" to ¼". C. E. M. COMPANY, 24 School St., Danielson, Conn.
Circle Inform-A-Gram No. B15.

The Alina Profiling Head which permits the turning of both internal and external profiles, if continuous cut, is featured in bulletin. Square, hex, octagonal, and other multi-sided profiles are easily formed. Collets; stamping, drawing, and forging dies; gages; and other applications are readily found. Cylindrical and taper forms can also be formed. The Alina head is used on any sturdy machine—lathe, radial drill press, milling machine, or boring mill. A simple templet, ¼" thick, bearing the profile to be cut is inserted into the head; the head does the rest. An ordinary boring tool bit is used for all operations. ALINA CORPORATION, 32 Broadway, New York 4.
Circle Inform-A-Gram No. B16.

Western Buyers of Steel Forgings will note the expanded production facilities now available on the Pacific Coast. A new brochure, "Allegheny Ludlum Serves the West" describes that company's production, sales, and service facilities in the Western states. For your copy, address the ALLEGHENY LUDLUM STEEL CORP., Oliver Bldg., Pittsburgh 22, Pa.
Circle Inform-A-Gram No. B17.

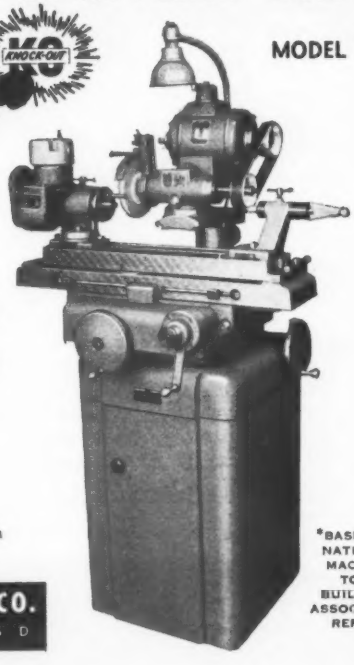
New Pocket-Size End Mill Catalog lists over 500 types and sizes available for all purposes. Included are "Hi-Helix", die sinking, profiling, Keller, and other types of end mills; end mill reamers; shell end mills; tracer points and other small tools. Technical data section of catalog includes terminology chart, tips for better end mill use, identification of mills; cutting speed and feed recommendations; suggestions for sharpening and inspecting end mills; and other helpful information. PRATT & WHITNEY, West Hartford 1, Conn.
Circle Inform-A-Gram No. B18.

Bolts & Cap Screws Are Economically Pointed with high speed automatic machine, Type 4600. Bulletin cites many features, including hopper feed, full-mechanical movements, easy access to internal parts, spindle speeds infinitely variable from 950 to 1750 rpm, infinite production rates from 1800 to 5400 pcs/hr, quick-change pointing heads, and ability to make all types of points with a single machine. One operator can tend several machines. THE ECONOMY ENGINEERING CO., Vine St., Willoughby, Ohio.
Circle Inform-A-Gram No. B19.

There's a reason 71%*

of all popularly-priced Tool and Cutter Grinders sold in 1951 were "Knock-Outs"

MODEL B860



Will do anything that machines costing 2 or 3 times more will do . . . yes and in less time.

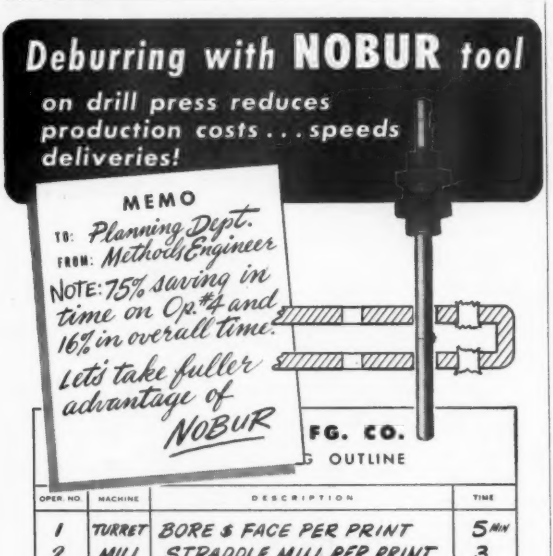
Distributed Only Through Franchise Dealers

K. O. LEE CO.
ABERDEEN S D

*BASED ON NATIONAL MACHINE TOOL BUILDER'S ASSOCIATION REPORT

Universal Milling Cutters, featuring one-body design for high-speed steel or carbide inserted blades, are described in new bulletin. Blades only need be changed for right-hand or left-hand rotation, for positive or negative angles. "Super-Jack" wedges lock blades accurately and rigidly . . . are unlocked easily, using set screw wrench. Method of insertion provides superior rigidity for heavy cuts at high speeds. Fine pitch adjusting screw permits sensitive adjustment of blade to an indicator. McCROSKY TOOL CORP., Meadville, Pa.
Circle Inform-A-Gram No. B20.

Tremendous Holding Power and universality of application are principal advantages of Magna-Lock magnetic chucks, described in Bulletin 050. Features include moisture-proof construction, uniform distribution of holding power, shock-proof electrical system, ease of maintenance, three basic types, wide range of sizes, complete line of standard accessories. The various types and their application are illustrated. Also shown is the Magna-Vise for holding of non-magnetic materials. Write to HANCHETT MAGNA-LOCK CORP., Big Rapids, Mich.
Circle Inform-A-Gram No. B21.


Deburring with NOBUR tool
on drill press reduces production costs . . . speeds deliveries!
MEMO
TO: Planning Dept.
FROM: Methods Engineer
NOTE: 75% saving in time on Op. #4 and 16% in overall time.
Let's take fuller advantage of NOBUR
FG. CO.
OUTLINE
OPER. NO. | MACHINE | DESCRIPTION | TIME
1 | TURRET | BORE & FACE PER PRINT | 5 MIN
2 | MILL | STRADDLE MILL PER PRINT | 3
3 | DRILL | 10 HOLES LINE DRILL | 6
4 | BENCH | DE-BURR HOLES | 4
4 (REV.) | NOBUR TOOL IN DRILL PRESS | NOBUR HOLES | 1
TOTAL 18 15
For further information, write or wire today
NOBUR MANUFACTURING COMPANY
717 NORTH VICTORY BLVD. • BURBANK, CALIFORNIA

Spray Application of Design Layout Ink is announced in new bulletin, describing ink which comes in self-pressurized aerosol container. Ink dries to hard film in approximately one minute, leaving a smooth, even and non-glare surface. Eliminates nuisance and messiness of brushed-on layout ink. CROWN INDUSTRIAL PRODUCTS CO., 5186 Park and Borden Aves., Sycamore, Ill.
Circle Inform-A-Gram No. B22.

Fast, Accurate Setting of Boring Bits in a precision boring bar can be done with new tool setting gage. Micrometer sleeve is mounted for limited axial movement, revealed by dial indicator. Gage can be set to the desired projection of tool point, with indicator showing departure from correct setting. Extremely accurate readings are obtained by merely holding instrument base against ground boring bar. This method permits toolroom setting of boring tools, saves setup time on production machines, and eliminates trial-and-error scrap. Data sheet available from EUCLID INSTRUMENT CO., 743 E. 232nd St., Euclid, O.
Circle Inform-A-Gram No. B23.

Revolutionary Improvements in Die Casting are reflected in the new line of machines introduced by Lake Erie. Increased hourly production due to positive clamping pressure during each machine cycle is provided by a "Wedge Cam Toggle" with its self-compensating adjustment for heat expansion. Greater and more uniform density in casting is assured by means of an automatic pressure booster in the hydraulic circuit between accumulator and injection cylinder. Push-button controls, centralized valves, and hydraulic core pulls are among other features illustrated in Bulletin 23-1 available from LAKE ERIE ENGINEERING CORP., Buffalo 17, N. Y.
Circle Inform-A-Gram No. B24.

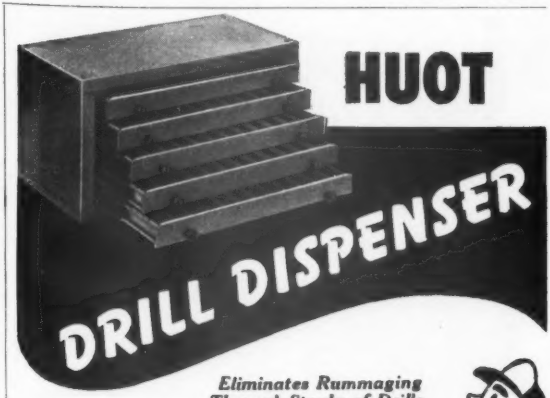
Form Trueing of Complicated Contours on grinding wheels up to 20" dia. is now possible on new larger Diaform attachments. Model 4A is designed for horizontal grinders having clockwise spindle rotation, Model 4B for those having counter-clockwise wheel rotation. These provide faster, more accurate cutting of forms up to 3" wide and 1" deep, reducing to hours many jobs that formerly required days. The Diaform technique utilizes 3 tracer-guided diamonds, simultaneously roughing, semi-finishing, and finishing. Trueings can be repeated with same accuracy as often as required, thus permitting equally uniform accuracy in tools and gages being form-ground. For Circular 548, address PRATT & WHITNEY, West Hartford 1, Conn.
Circle Inform-A-Gram No. B25.

Excellent Color and Fine Finish can be imparted to copper, brass, bronze and copper alloy stampings, castings and other parts that can be barrel tumbled, by using Blue Magic burnishing compound. This is a free-flowing powder that may be used with any coated abrasives, quarried stones, steel balls, or other commonly used burnishing media. Detergency and rinsibility are outstanding characteristics. Ask for Bul. 11 from BLUE MAGIC CHEMICAL SPECIALTIES CO., 2135 Margaret St., Philadelphia 24.
Circle Inform-A-Gram No. B26.

Increased Productivity on Many Operations is made possible by use of "Linemaster" foot treadle switch, which leaves both hands free for other work. Can be used for starting and stopping motors, or for actuating relays, solenoids, and magnetic switches. Switch is designed for optional use mounted on side of bench or machine and operated by slight pressure of knee. It can be provided with safety guard to prevent accidental tripping of switch. Bulletin available from SIMONDS MACHINE CO., INC., Southbridge, Mass.
Circle Inform-A-Gram No. B27.

Catalog of Machine Knives presents a wide variety of knives for wood, paper, fibre, and plastic products. Knives are available in high-speed steel, hardened and tempered; solid high carbon steel; low carbon steel with inlay of high carbon steel for the cutting and facing edge; or low carbon steel with inlay of high speed steel. Knife types include standard fly knives for Taylor Stiles cutting and shredding machines, plane knives, thin knives, moulding knives, trimming knives, and shear blades. TAYLOR, STILES & CO., Riegelsville, N. J.
Circle Inform-A-Gram No. B28.

Production Control Is Facilitated by use of automatic stroke and revolution counters catalogued in Bulletin 53A. In addition to various mechanical counters, a line of electric counters is offered for remote reading, being operated by switch relay, photo-electric unit, or other circuit-breaking device. These counters are available for flush mounting on panelboards or in cabinet panel units. Various actuating switches and photo-electric units are also listed, as are monitoring automatic batch counters. PRODUCTION INSTRUMENT CO., 710 W. Jackson Blvd., Chicago.
Circle Inform-A-Gram No. B29.



Eliminates Rummaging Through Stacks of Drills

No more running out of drills—your entire stock can be seen at a glance. Each size of drill has its own compartment with rounded bottom for easy selection. You can store dozens of small drills and several large ones in their own compartments. Built-in pricing or inventory system eliminates the need for cost sheets, and will keep a record of drills on hand. Stack two or three cabinets to save space. Specifications: 14½" long, 7¼" high, 7¼" deep. Hammerlin baked enamel finish over rugged steel.

Made in three models for fractional, number or letter drills.

WRITE FOR CIRCULAR

"HUOT" is pronounced "HEW-IT"

HUOT MANUFACTURING CO.

581 No. Wheeler St., St. Paul W4, Minn.

By the makers of **HUOT DRILL INDEX**

Positive Indexing of Large Work on upright and radial drills is accomplished by table type indexing trunnion, which simplifies jig construction, reduces setup time, and minimizes operator fatigue. For data sheet, write to JOHNSON & BASSETT, INC., Worcester, Mass.
Circle Inform-A-Gram No. B30.

Cut-off Wheels Recommended for machines made by Stone Machinery Company are listed and described in Bulletin 6921, now available from Abrasive Wheel Dept., MANHATTAN RUBBER DIV'N, Raybestos Manhattan, Inc., Passaic, N. J.
Circle Inform-A-Gram No. B31.

Production Chamfering of Hypoid Pinions is subject of Technical Bulletin 2041, covering the Universal Burr-Master machine. Address requests for bulletin to MODERN INDUSTRIAL ENGINEERING CO., 14230 Birwood Ave., Detroit 4, Mich.
Circle Inform-A-Gram No. B32.

Interesting Case Histories of cost-cutting Multipress applications are pictured and described in detail in the latest issue of Denison's external house organ. To get your name on the mailing list, address THE DENISON ENGINEERING CO., 1197 Dublin Rd., Columbus 16, Ohio.
Circle Inform-A-Gram No. B33.

TRIPLE PURPOSE MACHINE
FILES...SAWS...STONES
ILLINOIS DIE FILING MACHINE
An accurate, smoothly-operating machine that files, saws and stones the most intricate die shapes... eliminates tedious hand operations...reduces costs. It is quality-built for long, trouble-free service ... hardened and ground shafts running in bronze bushings minimize wear. The holding chuck and clamping device provide perfect file alignment.
Sawing
Write for descriptive literature
Stoning
ILLINOIS TOOL WORKS
2501 N. Keeler Ave. • Chicago 39, Ill.
MANUFACTURERS OF METAL CUTTING TOOLS AND SHAKEPROOF PRODUCTS

"Swiss Finish" Cutting Tools —both carbide and high speed steel—are listed in new Waukesha catalog. Included are adjustable heavy-duty, short and long shank reamers, shell reamers, spade drills, arbors, etc. Recommended cutting speeds and hints for grinding reamers follow the catalog information. Tools feature cushioned blades, positive shearing action, and exceptional performance. WAUKESHA TOOL CO., Waukesha, Wisc.
Circle Inform-A-Gram No. B34.

Screw Machine Tooling—circular cut-off and form tools; sealed revolving stops, combination roller stops and supports; hollow mill and releasing die and tap holders; drill chucks; B & S cams—all listed in 36-page Catalog No. 8. This may be obtained from THE ALCO COMPANY, Bridgeport 4, Conn.
Circle Inform-A-Gram No. B35.

Fast, Precision Finishing of Internal Cylinders by honing is explained and illustrated in new 16-page bulletin. Four basic machines are shown, together with detailed information on honing tools, selection of hone bodies, stones, and coolants. Discussion of equipment is prefaced with analysis of honing principles, together with graphic illustration of geometrical inaccuracies that can be corrected — ovality, waviness, taper, and bow. C. ALLEN FULMER CO., 1211 First National Bank Bldg., Cincinnati 2, O.
Circle Inform-A-Gram No. B36.

Increased Usage of Your Horizontal Mill with an all-universal vertical milling head, available in 25 models and sizes to fit most standard horizontal millers. This is a compact, rigid attachment featuring exact calibration, micrometer type quill, easy installation, preloaded bearings and spindle, and silent gear assembly. For bulletin write BROWN MILL-TOOL CO., 5475 San Fernando Road West, Los Angeles 39.
Circle Inform-A-Gram No. B37.

Rapid Production of Precision Parts from bar stock or chucked blanks can be obtained with No. 2 ram type turret lathe, which features micro-speed drive, speed selection by push-button control while spindle is operating in either direction, electric speed indicator, power feed to turret, helical headstock gears, antifriction spindle bearings, and sturdy construction throughout. Bulletin may be obtained from SIMMONS MACHINE TOOL CORP., No. Broadway, Albany 1, N. Y.
Circle Inform-A-Gram No. B38.

Users and Manufacturers of Hydraulic Equipment with rotating parts exposed to severe acid, alkaline, eroding, and abrading conditions will welcome this line of industrial glass bearings. In addition to glass-lined steel sleeve bearings, pillow block bearings, flanged bearings, and matched self-lubricating rubber journals, there are now available turbine pump column spiders made of cast iron and completely armored in glass. With wet rubber sliding over glass surface, friction is almost completely absent; and bearings will far outwear others under most operating conditions. Bulletin available from FARLEY M. CALDWELL, 1107 Richwood Ave., Cincinnati 26, Ohio.
Circle Inform-A-Gram No. B39.

Triple-Purpose Alloy Steel is fully described in folder, which includes recommendations for heat treatment and tables of physical properties. Called No. 5-876, the new steel meets 3 distinct service requirements (1) used as received, it can be readily machined and used as a mild-tempered alloy steel; (2) drawn between 700° and 1200°, it fills requirements of tough-tempered parts such as shafts, axles, bolts, studs, etc., (3) drawn between 400° and 550°, it has the properties needed for hard-tempered parts, such as gears, racks, clutch pins, etc. Write to THE CARPENTER STEEL CO., 306 W. Bern St., Reading, Pa.
Circle Inform-A-Gram No. B40.

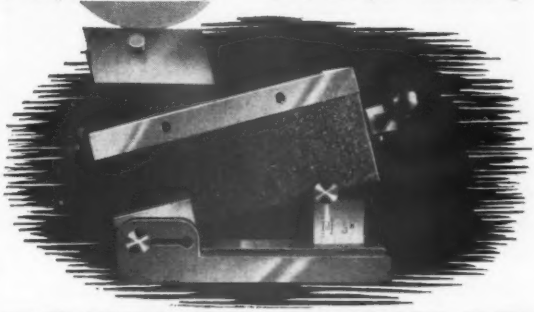
Collapsible and Solid Adjustable Taps are listed and described in Catalog T-51. Among the products included are taps applicable to both revolving and non-revolving spindle machines, chaser grinding fixture and adaptors. THE NATIONAL ACME CO., Cleveland 8, Ohio.
Circle Inform-A-Gram No. B41.

Centering Device for Drill Presses holds round, square, and hex bars with firm grip. Stock up to 2" dia. for turning operations can be accurately centered, relieving costly lathe time. Up to 450 pcs/hr can be handled. Data Sheet available from CHAMPLAIN MOTORS, INC., St. Albans, Vt.
Circle Inform-A-Gram No. B42.

Unbrako Pressure Plugs, using Dryseal method of pressure sealing, prevents spiral leakage which is a common problem under severe operating conditions. Bulletin 675-2 is available from STANDARD PRESSED STEEL CO., Box 600, Jenkintown, Pa.
Circle Inform-A-Gram No. B43.

Flat Head Socket Cap Screws are listed in a handy, pocket-sized folder. In addition to listing standard sizes, folder describes pertinent features of these fasteners and the laboratory testing methods by which they are checked. THE HOLO-KROME SCREW CORP., Hartford 10, Conn.
Circle Inform-A-Gram No. B44.

FASTER-SIMPLER



POSITIVE ANGULAR ACCURACY

the MAGNA-SINE

SEND FOR CATALOG

For any angular set-up, whether single or compound, simply insert standard gauge blocks between the Magna-Sine plates. Proper gauge blocks are indicated in the Robbins Table of Constants. Positive accuracy in a few moments. Work is securely held by magnetic attraction. In two models and sizes; also non-magnetic models for inspection set-ups.

OMER E. Robbins COMPANY

Manufacturers of the MAGNA-SINE and Other Precision Tools

5722 TWELFTH ST. • DETROIT 8, MICH.

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

A Complete New Line of Flexible Shaft unit drives are announced in Catalog 210, which lists four size ranges. The heavy duty range—for applications requiring high strength, moderate flexibility, and lower operating speeds—includes 180 standard units that vary according to style of end fittings, bearings, length of shafting, and core diameters. "Econoflex" medium duty drives may be attached to any power source and used to perform all normal flexible shaft machine operations. ELLIOTT MANUFACTURING CO., 305 Prospect Ave., Binghamton, N. Y.
Circle Inform-A-Gram No. B45.

New Metallic-Base, Solid-Film Lubricant for high temperature, high pressure, high speed application has been the subject of numerous investigations, laboratory and field testing programs. "Abstracts, Bibliography and Case Histories of Liqui-Moly (Molybdenum Disulfide) Lubrication" is a new Technical Bulletin. Included are the results of **static** friction tests, oxidation, and fretting corrosion, as well as field findings in the drawing of stainless steel, rolling, machining, hot forging, etc. For Tech. Bul. 21-G, write Lubricants Div'n, THE LOCKREY COMPANY, Southhampton, N.Y.
Circle Inform-A-Gram No. B46.

SAVE TIME AND MATERIALS

Oil-hardened tool steel tapered pin gages accurate to + 0.0001" − 0.0000" insure dependable sizing and location of holes and slots for machinists, set-up men, tool and die men, inspectors, all who need precise hole measurement.

CONCENTRIC TAPER on lower half of each gage fits holes 0.0012" smaller than standard letter, fraction, and number size drill holes. Makes insertion easier. Permits gaging of odd-size holes and slots.

ALL GAGES are 1½ inches long. Sets contain a pair of each size in a plastic case with 4-place decimal equivalents of each size plainly marked.

ALL ITEMS STOCKED FOR IMMEDIATE DELIVERY

THE *Horberg* GAGE COMPANY

Quantity 29 STAPLES ST., BRIDGEPORT, CONN.

..... Letter sets @ $45. 52 gages (A-Z)
..... Fraction Sets @ $50. 60 gages (1/64" to 1/2" in 1/64" steps)
..... Number Sets @ $90. 120 gages (1 to 60)
..... Single gages @ $ 1.
..... Stand alone @ $10.

Please Rush checked items and literature to
company.....
address.....
name.....
title.....

Peterman Automatic P-16 for stock up to ⅝" dia. features extra precision at all 9 spindle speeds, ranging from 1000 to 5000 rpm. There are 27 camshaft speeds available for each headstock speed. Accelerator speeds up camshaft rotation during "idle" time. All principal working parts are lubricated automatically. Six tools are independently operated, with micrometer adjustment of each tool holder. For Bulletin 49E, write to importers RUSSELL, HOLBROOK & HENDERSON, INC., 292 Madison Ave., New York 17.
Circle Inform-A-Gram No. B47.

Expanding Mandrel grips and releases the workpiece on the inside surface. The newly-developed one piece "Collet-mandrel" works like a conventional collet in reverse, offers an ideal 3-point gripping surface, is fast gripping, long lasting, and fast releasing. Available for I.D.'s ranging from ¼" to 1". Send to E. WESTBERG CORP., 800 Beley Ave., Syracuse 11, N. Y., for your copy of descriptive bulletin.
Circle Inform-A-Gram No. B48.

New Magnetic Brake, containing only 6 major parts and ½ conventional length and weight, is described in circular now available. All linkage has been eliminated through the use of a new type solenoid, which also permits the motor shaft to extend through the brake making possible two output shafts. Spring action applies brakes while release is obtained magnetically. Wear adjustments on lining are completely automatic. REULAND ELECTRIC CO., Alhambra, Cal.
Circle Inform-A-Gram No. B49.

Selection of Bronze Electrodes and the application of proven welding techniques for a wide range of repair and maintenance work is the subject of an 8-page reprint, "Jobs You Can Do with Bronze Electrodes". Request your copy from AMPCO METAL, INC., 1745 So. 38th St., Milwaukee 46, Wisc.
Circle Inform-A-Gram No. B50.

Work Holding with Standard Adjustable and universal face plates, fixtures, and attachments cut tooling costs and enable infinite variety of work to be held with a minimum range of standard equipment. In many cases, single purpose machines are adapted in minutes to do the work of others. Bulletin illustrates application of 24 low-cost fixtures for all standard machine tools. MICRO LATHE PLATE CO., INC., 1265 W. 2nd St., Cleveland 13.
Circle Inform-A-Gram No. B51.

Automatic Indexing Tables, available as standard with 2 to 36 stations, offers combination of accuracy, speed, smoothness, power, and versatility. Only one horsepower is required to operate a 24" unit with 800-lb. work load. Adaptable to infinite variety of milling, drilling, boring, stamping, assembling, and other operations. For descriptive bulletin, write to TURNER BROS., INC. 2625 Hilton Rd., Ferndale 20, Mich.
Circle Inform-A-Gram No. B52.

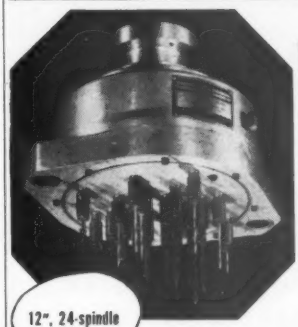
Steel Storage Racks for drums, barrels, crates, bins, skids and pallets are presented in new Bulletin 5221, which illustrates many storage problems with rack installation views. Bulletin shows how floor space can be saved, how handling costs can be reduced, how breakage and damage of stored goods can be prevented. Barrel racks include selective drain racks, which permit removal of barrel contents without removing it from the rack. BARRETT-CRAVENS CO., 4609 S. Western Blvd., Chicago 9, Ill.
Circle Inform-A-Gram No. B53.

Creative Engineering, Tooling, and Parts Production services and facilities are offered in new 8-page booklet. Experience, personnel, and physical facilities available are highlighted, together with a list of industries now being served by this firm. A. W. HECKER COMPANY, 7110 Euclid Ave., Cleveland 3, Ohio.
Circle Inform-A-Gram No. B54.

New Milling Technique opens up new fields for design and manufacture of dies, tools, intricate parts. Bulletin describes Swisma Milling Machine, a Swiss precision machine that is fast and economical for vertical milling, drilling, and other operations. Without templets, this machine will produce multi-sided holes with flat, concave, or convex surfaces. Corners are milled to a radius 1/10 distance across flats, and can be sharpened in a second operation. Simple to set up, and simple to use. GUBELIN INTERNATIONAL CORP., 35 W. 53rd St., New York 19.
Circle Inform-A-Gram No. B55.

"The Selection and Use of DESEGATIZED Hi Carbon - Hi Chrome Die Steels" is a new bulletin on properties and general applications of 5 widely used steel types. The improved impact strength of these types as compared with that of standard types of same composition, is graphically demonstrated. Desegatized steels exhibit no harmful carbide segregation, yet contain the free carbides necessary for abrasion resistant qualities but evenly dispersed throughout the mass. Advantages include ease of machining, extra toughness. Available from LATROBE ELECTRIC STEEL CO., Latrobe, Pa.
Circle Inform-A-Gram No. B56.

RAISE YOUR HOLE QUOTIENT WITH A STANDARD Zagar GEARLESS DRILLHEAD...



12", 24-spindle drillhead; capacity to ¾" in steel.

drills any number of holes in any pattern

Drill a maximum number of holes in one pass—in any material. Holes can be as close as twice drill diameter. Zagar gearless drillheads are built as a complete unit or may be adapted to any standard drill press. Send us your part drawing and we will submit our quotation.

Write for Manual T-5

ZAGAR TOOL, INC., 24000 Lakeland Blvd., Cleveland 23, O.

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Rotating Impact Riveters permit riveting on fragile, unsupported and soft parts as well as heavy work. The "Airflex" riveters are available for either manual or automatic operation. They are adaptable to the use of any length solid or hollow rivets, are equally efficient for riveting tight or loose joints. Pneumatic powered, their rugged construction is coupled with simple design to give maximum service with minimum maintenance. Obtain your copy of Bul. 74 from LEMERT ENGINEERING CO., Plymouth, Ind.
Circle Inform-A-Gram No. B57.

Grinding and Lapping Machines for many purposes are illustrated and described in 24-page catalog, No. 1843-10. Features noted on the cylindrical grinders include rapid and accurate stock removal, precision built wheel spindle unit with ruggedness for heavy stock removal, automatic truing device which functions automatically after settings are made and operates on push-button control. Other grinders included are toolroom, universal, surface, and special purpose types. NORTON COMPANY, Worcester 6, Mass.
Circle Inform-A-Gram No. B58.

Trimming Formed Parts
AND HUNDREDS OF OTHER
CUTTING JOBS are FRICTION SAWN
QUICKER and BETTER
with **Tannewitz**
HIGH SPEED BAND SAWS!

Get your FREE COPY OF "FRICTION SAWING"

Friction sawing with Tannewitz High Speed Band Saws is much faster, easier and better than any other method of cutting formed parts, flat sheets of either soft or hard steel, non-ferrous metals, glass, plastics and many other materials. Down-drag of saw is so little that no rest of any kind is needed in trimming formed parts or castings. Savings in time and costs are immense.
THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

Internal Tri-Point Micrometer measures bores and holes directly, without need for masters. Eliminates the need for many setting rings or plugs. Points are ground cylindrically on ends to make line contact with bore. . . instrument being self-aligning axially. The "Intrimik" comes in 16 individual sizes, and in 4 sets, ranging from .275" to 4.000" gaging diameter. Extensions are available for deep-hole measurements. BROWN & SHARPE MFG. CO., Providence 1, R. I.
Circle Inform-A-Gram No. B59.

Pre-Assembled Braze Sandwich saves material, time, and temper. "Bondwich" combines brazing alloy and ductile shim, ensures complete wetting, permanent bonding, and minimizes the possibility of thermal strains. A copper-nickel alloy is presently used as standard for the shim. Other alloys are available on special order. For Technical Bulletin 707A, write to GENERAL PLATE, Div'n of Metals & Controls Corp., Attleboro, Mass.
Circle Inform-A-Gram No. B60.

High Speed Tapping in Steel is express purpose of super sensitive tapping head for standard drill press. Fingertip sensitive control is a fundamental feature. Circular mentions tapered shank for positive fit, telescoping spindle, knurled control collar, lock screw to engage overload clutch for small taps or disengage clutch for larger taps. Will tap 0-80 to 4-40 holes. WINSLOW PRODUCT ENG'G CORP., Los Angeles 22.
Circle Inform-A-Gram No. B61.

Condensed General Press Catalog. 28 pages, describes and illustrates the company's complete range of mechanical and hydraulic presses, and special machinery for many types of metal forming operations. Provides excellent visible index to available standard press equipment. E. W. BLISS COMPANY, Canton, Ohio.
Circle Inform-A-Gram No. B62.

Accurate High Speed Contour Milling of extra-long dimension parts, such as aircraft spar beams and cap strips is specific purpose of Onsrud automatic miller. Two vertical and two horizontal heads may be employed on a single pass. Work is held stationary on beds, now available in standard length units of 15' starting with basic 30' length. Write for Bulletin 1136 to ONSRUD MACHINE WORKS, INC., 3941 W. Palmer St., Chicago 47, Ill.
Circle Inform-A-Gram No. B63.

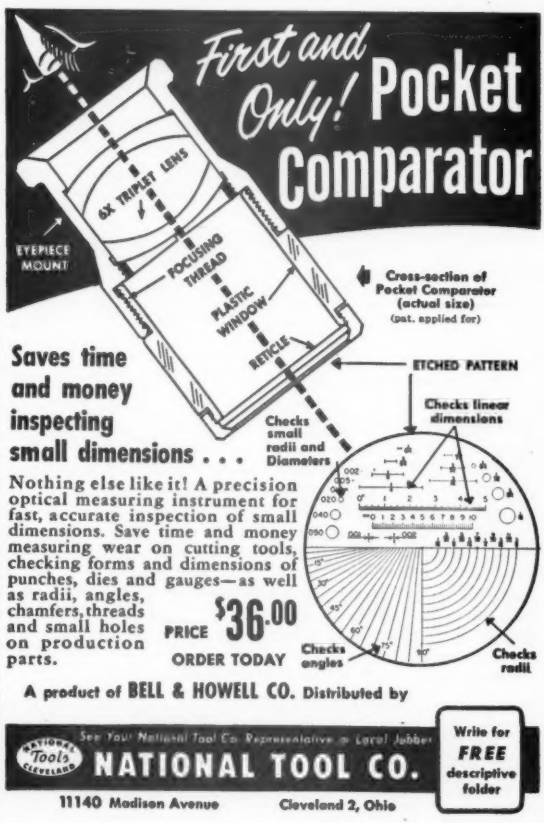
Special Cutting Fluids for "difficult" operations where general purpose cutting fluids cause excessive tool wear and poor surface finishes, have recently been developed. These are available for machining of stainless steels, high carbon steels, and similar materials; for grinding; for jobs where staining of copper is to be avoided; and where those greater cooling qualities are required. For further information, write Lubricants Division, Dept. TP, MAGNUS CHEMICAL CO., INC., Garwood, N. J.
Circle Inform-A-Gram No. B64.

Fast, Economical Chrome Plating of small tools or parts in limited or large quantities is feature of compact Chromaster A-250. Ideal for production plating, with average plating time for cutting tools being 3-½ min. All controls and power unit are built in. For Bulletin IC-250, write to Industrial Chrome Div'n, WARD LEONARD ELECTRIC CO., Mt. Vernon, N. Y.
Circle Inform-A-Gram No. B65.

A New Line of Horizontal Broaching Machines in normal capacities of 15, 20, or 30 tons, is announced in Circular No. 501. These heavy duty, hydraulic machines carry as standard equipment electrical and hydraulic circuits conforming to JIC standards, and provide for increased broaching and return speeds. AMERICAN BROACH AND MACHINE CO., Ann Arbor, Mich.
Circle Inform-A-Gram No. B66.

Milwaukee Profile Grinder, built to perform a wide variety of grinding operations, is especially adapted to the precision grinding of die clearances and the sharpening of cutter dies and punches. Special features include a powerful, high speed motor; reciprocating spindle mounted in self-aligning bearings; a tilting table; built-in diamond wheel dresser and other details for accuracy and adaptability. Obtain descriptive literature from RICE PUMP & MACHINE CO., No. Milwaukee St., Grafton, Wisc.
Circle Inform-A-Gram No. B67.

Safety Hammers — designed for use where it is necessary to strike a hard blow without injuring delicately machined surfaces—feature a head of gilding metal, a soft but tough homogenous casting which will flatten, but not fracture or chip. It is molded on end of light weight, resilient tubular steel handle which is pressed and crimped in the head so as to retain head permanently without the use of wedges, etc. Literature, announcing 14 sizes, available from UNIVERTICAL MACHINE CO., 109 W. Pleasant Ave., Detroit 18, Mich.
Circle Inform-A-Gram No. B68.


First and Only! Pocket Comparator
6X TRIPLET LENS
EYEPIECE MOUNT
FOCUSING THREAD
PLASTIC WINDOW
RETICLE
Cross-section of Pocket Comparator (actual size)
(pat. applied for)
ETCHED PATTERN
Checks linear dimensions
Checks small radii and Diameters
Saves time and money inspecting small dimensions . . .
Nothing else like it! A precision optical measuring instrument for fast, accurate inspection of small dimensions. Save time and money measuring wear on cutting tools, checking forms and dimensions of punches, dies and gauges—as well as radii, angles, chamfers, threads and small holes on production parts.
PRICE $36.00
ORDER TODAY
Checks angles
Checks radii
A product of BELL & HOWELL CO. Distributed by
See Your National Tool Co. Representative or Local Jobber
NATIONAL TOOL CO.
11140 Madison Avenue Cleveland 2, Ohio
Write for FREE descriptive folder

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Keeping Operators Safe

by **John Prati**
General Foreman
Tractor Works
INTERNATIONAL HARVESTER COMPANY
Chicago, Illinois

Safety training for the new employee begins at the time of employment. After a medical examination and approval for work, the employee is brought to his department by an employment interviewer and introduced to his foreman.

A. After the employee is introduced to the foreman by the representative of the employment department, he is put at ease and given instruction on his new job.

B. Did he ever work for this company? If so, how much service? If he has not, special care should be given in explaining the methods and practice set up in the department.

C. The foreman introduces the employee to the assistant on the job, who proceeds to explain the general instructions on the check list made with a duplicate copy, and as items are explained to the employee they are checked off the list. When the list is completed, the duplicate copy is given to the employee for future reference.

D. The assistant returns the employee to the foreman's office and the foreman proceeds to introduce him to the departmental Safety Inspector for a tour of the department.

See Page 168
for
Foremen's Daily Inspection Report

E. The first day the employee observes all the machines he will probably operate. Emphasis on co-operation with the safety program should be stressed by the foreman, die setter, and dependable operators who will take him to the kind of machines he will be working on and the parts which he should know about such as clutch, ram, foot and hand controls, and handling equipment for feeding and unloading of presses. If employee is hired for night work, he is usually kept on days for one week to make sure he understands the job thoroughly.

(Continued on page 202)

Mr. Prati's article originated as an address before the National Safety Council's 1951 Congress. We gratefully acknowledged the Council's permission to present it here. Ed.

(For Use With New Employees)
CHECK LIST

Employee's Name.....

Occupation.....

Number..... **Date Employed**.....

Experienced..... **Inexperienced**.....

TO DEPARTMENT FOREMAN

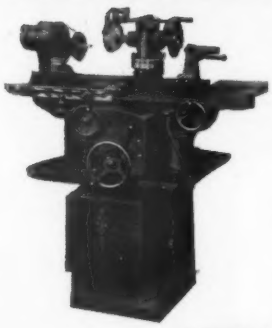
This form is to be used by your 2nd Assistant Foreman as a check list when imparting general information to a new employee. He is to indicate by a check mark (in ink) after each of the questions if the answer is yes. Then he is to sign and date it in the space provided at the bottom. You are also to sign this form after you have personally checked up on the new man after a week has elapsed to make sure the new man has retained the information given him by the 2nd Assistant Foreman. When the man is transferred, send this check list to his new Department Foreman.

Record on the back of this sheet any accidents this employee has while on the job, together with the date. Also record on the back, outstanding instances of laxity in maintaining quality or neglecting equipment. Likewise, any outstanding effort to maintain quality and take care of equipment. All notations to be made in ink.

SAFETY

Have you instructed him about safety on the type of work he is to do; such as the necessity for shutting off the power when setting up, adjusting, cleaning and oiling his machine?.....The danger of loose fitting garments, as long coats, aprons and neckties? .....The danger of wearing long sleeves, gloves, and rings?———About Goggles?.....About Safety Shoes?..... About Safety Meetings?..... Does he know where the stretcher is?.....How to report all injuries? .....And not to neglect small scratches? .....Has he met his Safety Dealer?.....Does he know smoking is allowed only in the washrooms

#2 IMPERIA UNIVERSAL TOOL & CUTTER GRINDER



Equipped with 4 A.C. Motors and arranged for external and internal grinding with automatic table movement. Accommodates No. 50 National Standard and B. & S. No. 12 taper shanks. Coolant system for wet grinding and radius dressing attachment are standard equipment.

Swing over table	10"
Distance between centers	20"
Surface of table	5"x32"
Longitudinal movement	13¾"
4 spindle speeds, RPM	2900 to 5800
Net weight	1,500 lbs.

ATTRACTIVE DELIVERY

Illustrated Quotation will be sent on request

PARKER MACHINE COMPANY, INC.

158 PIONEER STREET • BROOKLYN 31, N. Y. • TEL. TRiangle 5-2103 & 2157

Victor's Specials Deserve Your Attention!

High Speed Drills ... EXTRA LONG LENGTH

Straight Shank No. 1-60

No. By Gage	Length Inches	Our Price Net Each
1 to 10	6¼	$1.00
11 to 20	5¾	.90
21 to 30	5⅜	.80
31 to 40	5¼	.70
41 to 50	4½	.60
51 to 60	3½	.50

Straight Shank

Size Inches	Length Overall Inches	Length Flute Inches	Price Each Net
1/8	12	9	$1.65
9/64	12	9	1.65
5/32	12	9	1.65
11/64	12	9	1.65
3/16	12	9	1.65
13/64	12	9	1.80
7/32	12	9	1.80
15/64	12	9	1.95
1/4	12	9	1.95
17/64	12	9	2.05
9/32	12	9	2.05
19/64	12	9	$2.25
5/16	12	9	2.25
21/64	12	9	2.50
11/32	12	9	2.50
23/64	12	9	2.75
3/8	12	9	2.75
25/64	12	9	3.05
13/32	12	9	3.05
27/64	12	9	3.30
7/16	12	9	3.30
29/64	12	9	3.60
15/32	12	9	3.60
31/64	12	9	3.60
1/2	12	9	3.60

IMMEDIATE DELIVERY

VICTOR MACHINERY EXCHANGE, INC.

DEALERS IN TOOL ROOM EQUIPMENT

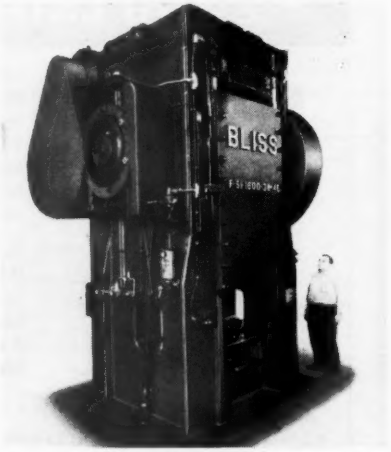
251 P Centre St. • New York 13, N. Y. • Phone CAnal 6-5575

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Improved High-Speed Forging Press

Development of an improved line of high-speed forging presses has been made by the E. W. Bliss Company. Built in capacities from 300 tons to 4,000 tons, the new line features a heavy duty air friction clutch and an air release spring set brake, both mounted on a full eccentric main shaft. The welded steel frame is designed with the main stress members located immediately adjacent to either side of the die seat and extending from the bottom of the bed to the top of the crown. These members have unusually heavy sections to keep the elongation of frame to a minimum when load is applied to press. A heavy plate, integral with the two front gibs, is bolted securely to the main stress carrying members. This plate, in addition to massive frame tying members in the rear of the press, opposes the inward deflection of frame toward the slide ways. The front of the slide has long and continuous gib ways extending up into the crown to keep the dies in alignment when off center loads are applied.

Regular equipment furnished with the press includes a cam knockout in the slide and a cam liftout in the bed. The die seat is a self-contained unit, equipped with an easily operated wedge adjusting machanism. This mechanism is arranged so that the die seat can be bumped to the correct front-to-back alignment without disturbing the adjusting mechanism. Wedges can be inserted between the die seat and the



frame uprights of the press for precision side-to-side alignment of the die seat.

To assist smooth operation at the relatively high speeds at which these presses operate, a "buffer" cylinder is installed in the crown which assists the brake in stopping the heavy slide at top stroke and furnishes additional accelerating force when starting the slide, easing the load on the clutch. A load indicator, which registers the actual load on the press by measuring the elongation of the frame uprights, is furnished is standard equipment.

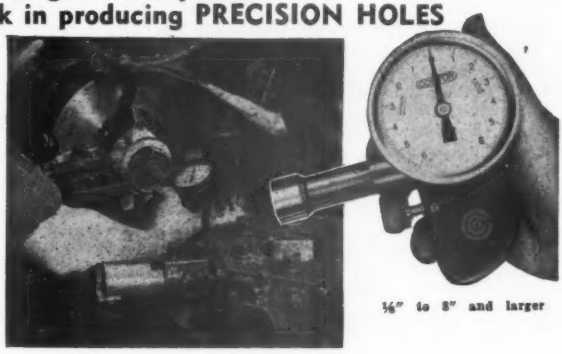
Precision Stampings Plant Expands

Completion of a new warehouse, installation of automatic presses and toolroom jig boring and jig grinding equipment has increased plant capacity of John Volkert Metal Stampings, Inc., by 20%. Volkert, a leading supplier of precision stampings and assemblies to electronics and electrical industries, shipped in excess of a million parts per day during 1951. The new ten-plunger eyelet machine shown has just been tooled to produce an intricate defense item.

MAXIMUM ACCURACY
IN DRILLING HOLES
"...it's the bushing that makes the wHOLE difference"
To maintain maximum accuracy in drilling operations, use the bushing that's precision made for the job . . . use Acme! Write for catalog.
Accurate
Interchangeable
Concentric
Acme Industrial Company
Makers of Hardened and Ground Precision Parts
200 N. LAFLIN STREET • CHICAGO 7, ILLINOIS
THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

Get a higher percentage of acceptable work in producing PRECISION HOLES

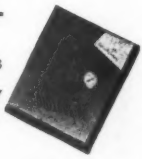
Amazing improvements in volume of production and precision of holes are on record as a result of giving machine operators COMTORPLUG. This unique hand gage, enables operator to keep machine adjusted better. Automatically and positively assures correct gaging to fractions of .0001". Detects out-of-round, tapers, bell mouth, etc. COMPLETELY AND POSITIVELY ACCURATE IN HANDS OF RELATIVELY UNTRAINED PERSONS — AT MACHINE OR INSPECTION LINE. Applicable to work still in chuck if desired; shows actual size —just right for Statistical Quality Control. THE Answer to war conditions, involving great urgency, green help, rough handling of gages.



½" to 8" and larger

COMTORPLUG gages bores to fractions of .0001"

Request Bulletin 46



COMTOR COMPANY
82 FARWELL STREET
WALTHAM 54, MASS.

We also make COMTORGAGE Precision External Gage

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

FOREMEN'S DAILY SAFETY INSPECTION REPORT

SHIFT TAKEN: 1.....: 2.....: 3.....: DEPT. .....

I HAVE CHECKED THE FOLLOWING FOR SAFETY: DATE.....

1. Acids
2. Air (Proper Use of)
3. Aisles
4. Barricade and Warning Signs
5. Bars (Probing or Leverage)
6. Belting
7. Blocking (Proper)
8. Boilers (Steam)
9. Burners (Acetylene)
10. Chains (Use and Care)
11. Chipping
12. Chips
13. Clamps
14. Clothing
15. Conveyors
16. Crabs (Lifting)
17. Cylinders (Oxy-Acetylene)
18. Dept. Safety Insp. (Intro.)
19. Die Swabs
20. Docks (Loading, Unloading)
21. Electric Cords
22. Electric Outlets
23. Electric Panel Boxes
24. Elevators (Loads)
25. Elevators (Operating)
26. Equipment
27. Falling Hazards
28. Fire Extinguishers
29. Fire Hazards
30. First Aid
31. Fixtures
32. Flammable Liquids
33. Flash Shields
34. Floors
35. Floor Loads
36. Furnaces (Lighting, etc.)
37. Fumes
38. Gloves
39. Goggles
40. Grinding Wheels
41. Guards
42. Hair Protection
43. Heat Exhaustion (Prevent)
44. Hand Tools
45. Hoists
46. Horseplay
47. Housekeeping
48. Jewelry
49. Keys (Die)
50. Ladders
51. Ladles (Handling of)
52. Lead Pots
53. Leggings
54. Lifting (Manual)
55. Lights
56. Machine Tools
57. Material (Handling)
58. Molten Metal
59. New Employee (Helping the)
60. Outside Safety
61. Ovens
62. Pallets
63. Personal Hygiene
64. Pulleys
65. Racks (Storage)
66. Ramps
67. Respirators
68. R.R. Track Clearance
69. Safety Shoes
70. Salt Dispensers
71. Sanitation
72. Scaffolding
73. Signals
74. Skids
75. Slings
76. Stairways
77. Steam (Live)
78. Stock (Piling of)
79. Stretchers
80. Tongs
81. Traffic (Plant)
82. Trucks (Gas, Electric)
83. Trucks (Hand)
84. Trucks (Lift)
85. Wet Sand (Foundry)
86. Welding (Arc)
87. Welding (Acetylene)
88. Welding (Resistance)
89. Yards
90. Others .....

.....

.....

Safety Order Issued .....

Shop Order Issued .....

Talked to Gen. Fore. .....

Talked to Safety Supr. .....

Talked to Dept. Safety Insp. .....

Talked to Employee .....

REMARKS: .....

.....

.....

.....

Completed: Yes .....

.....

Completed: No .....

.....

.....

Signature

PLEASE USE INFORM-A-GRAM FOR PRODUCT INFORMATION

Take Your Toolroom Off the Spot — *USE* OLIVER DIE MAKING MACHINES

Increase your efficiency, save time and headaches by installing the OLIVER Method for machine sawing, filing and lapping operations. Oliver Die Makers have proved their efficiency for almost 40 years. Many have been in continuous use for more than 25 years. Noted for their speed, accuracy and long lasting qualities, they have increased toolroom efficiency and effected savings up to 60% in thousands of plants throughout the World. Coupled with this is the fact that Oliver Die Makers are so simple to operate that skilled labor is not required — an important feature in these days of hard-to-get skilled man-power.

OLIVER DIE MAKERS Available in 5 Models

The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.

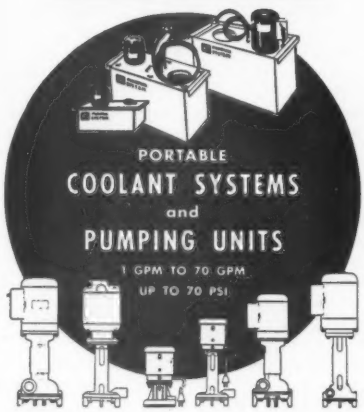
The Heavy Duty Model (illustrated) has 6 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.

***Write Today For Complete Technical Data on* OLIVER DIE MAKERS**

OLIVER INSTRUMENT CO.
1436 E. MAUMEE • ADRIAN, MICHIGAN

GET MORE PRODUCTION FROM YOUR MACHINES WITH —

GRAY-MILLS



PROPER application of coolants means increased production and time and tool savings. You can have these advantages for every machine—small, large, and special—with Graymills Portable Coolant Systems.

They can be installed in a few minutes, are modern in design, and of heavy duty construction with built-in automatic pressure relief valve on gear pumps.

Sturdy high pressure gear models . . . smooth high volume centrifugal types in 1/25 to ½ HP ratings, 1 gal. to 70 g.p.m. with tank capacities from 5 to 38 gals. Also immersion type centrifugal pump and motor units.

WRITE FOR NEW CATALOG SHOWING SELECTION CHART . . . TELLS THE RIGHT PUMP OR COOLANT SYSTEM FOR THE JOB.

MOST INDUSTRIAL DISTRIBUTORS STOCK STANDARD UNITS.

GRAYMILLS CORPORATION
3713 LINCOLN AVENUE • CHICAGO 13

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Carborundum's Universal Hub Contact Wheel

A product which offers the possibility of halving contract wheel cost, and providing a completely new factor of versatility, has been developed by The Carborundum Company.

An entirely new concept, the Universal Hub contact wheel consists of a three-part bolted metal assembly which includes a flanged Universal Hub, a T-61 serrated rubber tire and a side plate.

The tire, when worn out, is discarded, and is replaced by a new tire at half the cost of a standard new contact wheel replacement. In this way, the user can cut his contact wheel replacement costs in half.

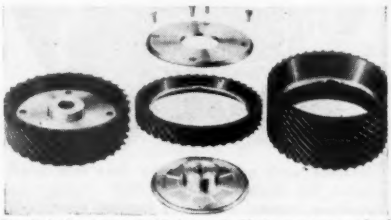
A single Universal Hub and plate unit will mount a variety of T-61 rubber tires of from ¼" up to 6" width, and from 5 to 105 durometer in hardness. This feature of interchangeability means that a single Universal Hub will take up to 144 different tires of varying width and/or durometer. The interchangeable feature thus permits everything from rough belt grinding down to the finest finishes on flat surfaces or contoured parts, employing the same basic Universal Hub, without removing the hub from the spindle. Tires can be changed in only a slightly longer time than that required to change a solid-hub contact wheel.

Each part of the Universal Hub assembly —hub wheel, plate and tire—is separately balanced. Thus, all hubs, plates and serrated rubber T-61 tires are not only interchangeable but are in balance in any combinations of assembled contact wheel units. Carborundum points out that in those instances where old-type worn-out rubber contact wheels used to be recovered, it will now be more economical to discard the old tire, then replace it with a new one. The new tire costs no more than the recovering of a solid-hub contact wheel, and time delays and shipping costs are eliminated.

These improvements have been achieved in such a way as to permit a price reduction on the complete 3-piece assembly of as much as 19 percent over the old-type wheel.

The Universal Hub design is the result of over three years of research and trial. The Chicago Rubber Company, as a result of a proposal by Carborundum, cooperated in its several successive stages of design and development. The design, when evolved, incorporated in the tire another joint development of the two companies—the "61" serrated rubber tread face. The "61" principle is now in wide use because of its outstanding demonstrated abilities to lengthen abrasive belt life on an extensive range of belt grinding and finishing applications.

The T-"61" contact wheel referred to is an entirely new type of contact wheel for abrasive belt application on backstand idlers. It is applicable to many types of operations in the metalworking field. This contact wheel permits the operator to get twice as much production from a standard abrasive belt, on those operations where glazing normally occurs, as he obtained with contact wheels previously in service with the same belts.



Exploded view of Universal Hub contact wheel developed by Carborundum. Assembly consists of Universal Hub, side plate and T-61 serrated rubber tire. Each part balanced so that assembled unit is in balance. Universal Hub and side plate will take up to 144 tires of varying width or hardness.

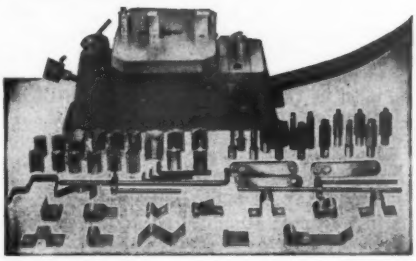
This wheel is a specially-serrated rubber wheel that causes a controlled breakdown in the bond of the abrasive belt. The result is that glazing, long the enemy of prolonged and productive belt life, is reduced to such a great degree that belt life is doubled.

While the idea of a serrated rubber contact wheel is not new, the unique characteristics of the new wheel—the relief angle, wide-spaced lands, narrowness of the lands, which are based largely on the design of milling cutters—are entirely new developments, and are responsible for

(Continued on page 174)

THE Multiform BENDER

CUTS, BENDS, PUNCHES - WITHOUT SPECIAL TOOLING

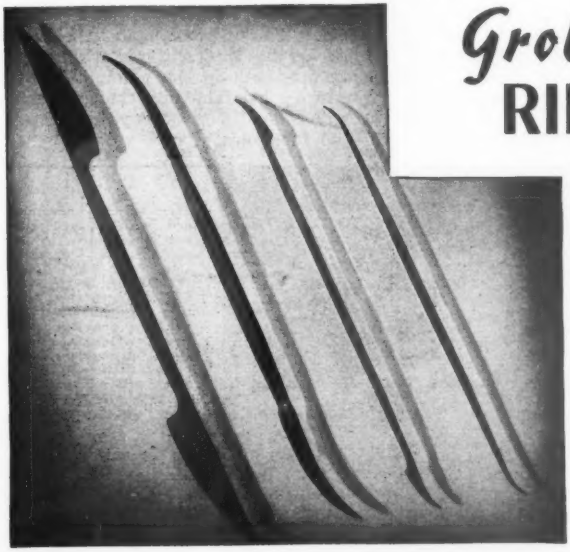


Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to punch, bend and cut round or flat brass, bronze, aluminum, steel, etc., up to 3/16" x 1½" as illustrated, other models up to ¼" x 4".

Write for descriptive literature.

J. A. RICHARDS CO.

NORTH PITCHER ST. KALAMAZOO, MICHIGAN



Grobet RIFFLERS

GROBET produces more RIFFLERS in more shapes and sizes than any company in the world.

SOLD THROUGH LEADING SUPPLY HOUSES.

Send for Catalog AF-3

GROBET FILE CO. of AMERICA, Inc.

421 Canal Street
New York 13, N. Y.

Plants: New York
Chicago - Montreal

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Special Slitting Machine

Fabrication of a wide variety of steel products involving the use of steel plates and bars in a broad range of sizes presents a serious inventory problem to many steel consumers.

To solve this inventory problem, Lewis Welding & Engineering Corp., designed and built a piece of equipment from salvaged material during the early part of World War II, when the shortage of steel was acute.

Faced with warehouse shortages in standard bar sizes and the continuous necessity of cutting non-standard widths, Lewis Welding built the special machine to provide the practical solution to meet peak production schedules.

The slitter consists of a structural steel frame mounted on four wheels and has something of the appearance of a miniature overhead traveling crane. A variable speed motor drive propels the unit along machined rails at the speeds appropriate to the thickness of the material being cut.

The actual cutting is done by one or more of the eight oxyacetylene torches mounted in special brackets along the main frame. It is possible to make 8 simultaneous cuts, producing 7 pieces in one pass of the slitter. Each torch can be adjusted separately so that any combination of widths can be cut at the same time.

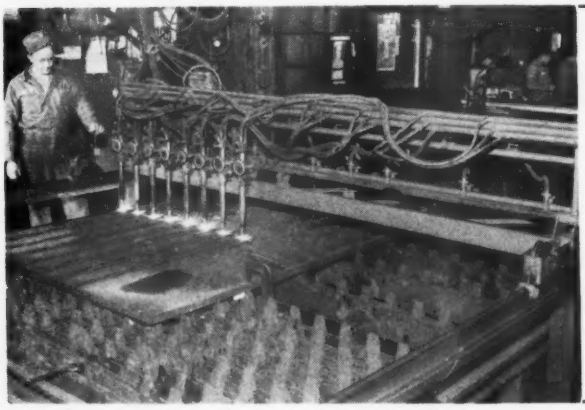
With this machine, stock plates up to 10′ in width and 30′ in length can be cut into strips without rehandling.

The slitter now serves many purposes beyond those originally planned. It cuts plates too thick to shear mechanically; it cuts plates too long or too wide to handle in conventional cutting equipment; and perhaps most important, the simultaneous cutting of two parallel edges eliminates most of the warping associated with long torch cuts.

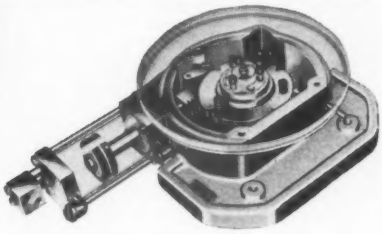
An auxiliary cutting machine, equipped with one torch, is operated on the same runway and is designed to cut at right angles to the main unit. Plates varying in thickness from ¼″ to 6″ are placed in position on the specially designed supports and do not have to be moved again until the cutting operations are completed.

The first machine proved so successful that a second one was designed which greatly increased the scope of the work and includes water quench nozzles to reduce further the heat-induced warpage which has occurred from time to time. This second unit was completed in 1948 and has been in continuous service ever since.

Operated by one man, the savings achieved by this slitter have been outstanding, both in the elimination of unnecessary handling and the avoidance of costly delays in these days of acute material shortages.



Steel bars of non-standard widths are easily cut from plates by the plate slitter, designed and built by Lewis Welding & Engineering Corp. A practical solution to the steel inventory problem presently plaguing many steel consumers, the plate slitter will cut stock plates up to 10 ft. wide and 30 ft. long into strips without rehandling. The slitter will cut plates too thick to shear mechanically, and simultaneous cutting of two parallel edges eliminates most of the warping.



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...without danger of galling or seizing!

The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15% — or more — under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel... simply turn adjustment screw.

Illustrated at left is Set No. 1. Six sizes (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2") with six brass and six steel barrels on wood stand, complete.....$12.75

Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16" and 3/4". For lapping holes smaller than 13/16", use the *Midget Lap*. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps).....$1.95

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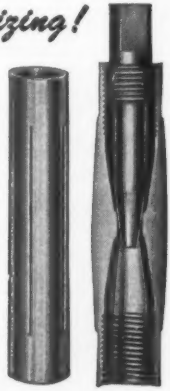


FEDERAL TOOL CORP. 3600 Pratt Blvd., Chicago 45, U. S. A.

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Contact Wheel, from page 170

the increase in belt life and cutting rates.

In a recent test in an industrial plant the new "61" wheel was applied in the flat surface grinding of auto bumpers prior to forming. Thirty-inch wide belts on Hill-Acme Co. wide-belt surface grinders were used. Previously 300 pieces were obtained per belt. With Carborundum's contact wheel, 600 pieces were obtained, with an increase of 128 percent in stock removal. Rejects were radically decreased and a much more consistant finish was realized from the first piece to the last. As a result, the "61" wheels are now being permanently installed on the production line.

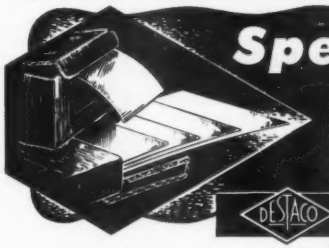
In the grinding laboratory of Carborundum's Coated Products Division, comparative tests were made on a belt backstand grinder using all known types of rubber contact wheels. The same belt type—14 ft. x 4 in. ‡80 ALO EC M—was used in each case on low-carbon 1015T descaled steel at 7350 surface feet per minute. It was found that the new wheel permitted the removal of 3 to 4½ times the total grams removed with the use of the other wheels. Similarly, belt life was increased from 2 to 5 times. Average work life was increased from 1.8 to 5 times, and very heat sensitive work life from 1.7 to 3.8 times. The chart of this performance record shows that, while cutting rates for the first few minutes of operation were as high or higher for belts employed on the other types of available wheels, these fast initial rates dropped off sharply. Belts on the new Carborundum wheel showed a markedly longer, over-all belt life and only a slight reduction in cutting rates—in fact, an average reduction of only .625 grams per minute over a period of 80 minutes operation.

These tests show that serrated rubber contact wheel represents a wholly revolutionary step in the development of the use of coated abrasive belts. In addition to longer life and higher stock removal rates, the new "61" wheel reduces the number of belt changes, and permits a more uniform finish, since the rate of cut over the life of the belt is more constant and loading is considerably diminished. Moreover, because the new contact wheel now assumes a heavy part of the work load, operator fatigue is effectively reduced. With increased belt life and cutting rates, new applications for abrasive belts, never before considered economically practical, now come within the range of possibility. To date this applies only in those operations where belts are discarded due to glazing and not in operations where abrasive coatings on belts wear down completely now—such as in extremely rough snagging. However, initial tests on the "61" wheel indicate a similar improvement in rough work.

14 FEET x 4 INCH No. 80 ALO EC M BELT PAPER BELTS TESTED ON LOW-CARBON 1015T DESCALED STEEL AT 7350 S. F. P. M.

Contact Wheels	Total Grams Removed (Belt Life)	Belt Life (Total Possible Contact Min.)	Effective Life Contact Minutes		Rate of Stock Removal in Grams per Minute							
			Average Work Life	Very Heat Sensitive Work Life	1 min.	4 min.	12 min.	24 min.	30 min.	40 min.	60 min.	80 min.
No. 50 Duro Plain	724	16	13	10	90	66	34	..	..	..	..	..
No. 50 Duro 1/2" x 3/8" Serrations	1030	24	20	13	75	66	42	17	..	..	..	..
No. 70 Duro 1/2" x 3/8" Serrations	1413	30	24	16	80	65	47	24	22	..	..	..
No. 60 Duro R-52 Wheels	1355	34	24	13	89	61	44	26	21	..	..	..
No. 60 Duro R-51 Wheels	1571	40	36	22	76	53	43	38	30	19	..	..
No. 70 Duro Type 61 Special Serrated Shape	3221	80	66	38	75	66	53	48	50	40	31	25

The No. 70 Durometer shown in the bottom line above is the new "61" wheel.



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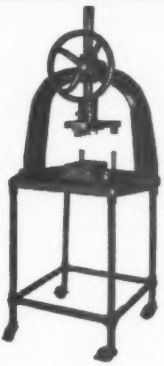

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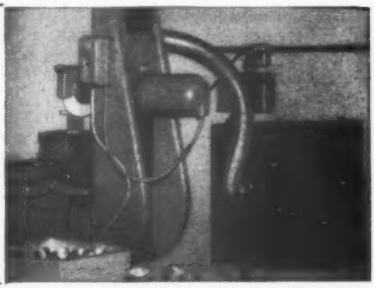


SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

New Air-Driven Internal Grinding Spindles Have Wide Speed Range

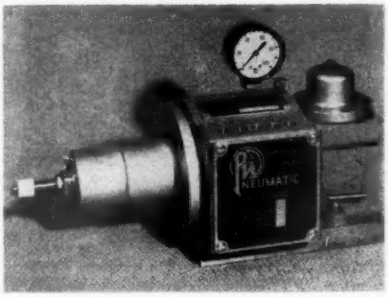
A new high speed pneumatic grinding head, which exhibits characteristics that surmount the difficulties usually associated with high speed spindles, has been developed by Pratt & Whitney, Div. Niles-Bement-Pond Company. It also reduces the skill required to produce ultimate results in hole accuracy and finish.

Two units are now in production to cover the wide speed range of 35,000 to 100,000 rpm. This range provides the most efficient cutting speed (approximately 5,000 surface feet per minute) for grinding wheels or points ranging from 5/32" to 3/4" in diameter. A low range unit can be adjusted to hold any selected speed within 35,000 to 50,000 rpm and a high range unit within 60,000 to 100,000 rpm.

The heads are designed to operate from an air supply providing approximately 25 cu. ft. per minute at 80 to 100 psi. Normal shop air lines are generally sufficient. A line filter is provided to clean the air before it enters the head, where it is distributed through internal passages to a turbine to drive the spindle, a speed governor control, and to the air lubricated bearings. Line fluctuation is removed by passing the air through a regulating valve to provide even pressure to the speed governor control.

One of the outstanding features of these heads, is their ability to operate under grinding load with very small drop from the preset idling speed. The speed governor control, which makes this possible, works on the principle of the air gage to measure the deflection of a ring of whirling cantilevers. Assembled to the inner end of the spindle, these cantilevers surround and nearly seal a small air orifice. As the turbine increases in speed, centrifugal force springs the cantilevers away from the orifice, unsealing it and causing a change in air pressure in the line feeding the orifice. This change in pressure is used to work the throttle valve which supplies the correct amount of power air to the turbine to maintain the preset speed regardless of grinding load.

Another feature of great importance is the air bearings on which the spindle floats. Ball bearings, at speeds above 35,000 rpm, require exceptional care in their construction and maintenance, with the difficulties increasing all out of proportion as the speed is increased toward 100,000 rpm. The simple air lubricated journals and thrust bearings, of this new design, have no apparent speed limitations, and function as well or better at 100,000 rpm, as at low speeds. The spindle and turbine are floated on air jets and make no metal-to-metal contact with bushings, except when bearing pressure is removed. Thus all rotating parts are free



to spin on the center of gravity of the assembly, providing the truest running spindle possible. With reasonable clean air supply, bearing life should be indefinite. Even if accident should cause metal-to-metal contact during operation, the bearings would not be damaged beyond the necessity of cleaning with a fine hand stone. The heads can be operated at any angle to the horizontal and run cool, even at highest speeds.

When first mounted, new grinding wheels are often eccentric and potentially dangerous if run at high speed for truing. As a safety feature, the P&W Pneumatic Grinding Head can be operated at any speed down to zero, to provide a safe truing speed to bring the wheel into balance.

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Split-Hair Precision Produces "Optical Gems"

Unique "optical gems", produced by elaborate precision methods at the Bausch & Lomb Optical Company's laboratories in Rochester, contributed much to the success of recent scientific studies at Khartoum, in Anglo-Egyptian Sudan. There, during the sun's total eclipse, photographs were made of the sun's spectrum through spectrographs capable of revealing elements in amounts as small as one part in 100 million. They were equipped with the "optical gems" — diffraction gratings, which replace the more common quartz or glass prisms for splitting light rays into a spectrum according to wavelength.

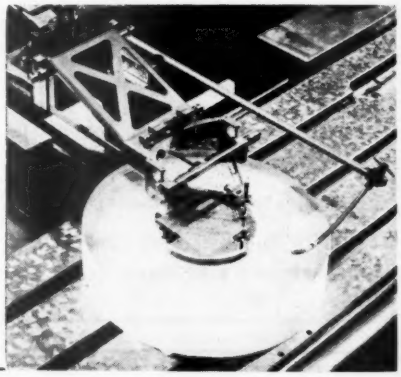
One of the diffraction gratings used at Khartoum. Its diamond-ruled surface, 5" x 6", has 135,000 lines—all equally deep, equally spaced, and precisely parallel.

These finely ruled gratings are produced on a super-sensitive ruling engine. Capable of extreme accuracy, it is also disturbed by the body heat of a person in the same room, by slight humidity, by minute vibrations. The engine is mounted on a 3-ton block of cement supported on steel springs and imprisoned in an aluminum room. This room is suspended within another room, and the entire unit buried under 250 tons of earth.

Adjustment of the cutting diamond may take several hours. No one is allowed in the laboratory while engine is operating. Fully automatic, the engine took 9 days unattended to rule the Khartoum "gems".

The multitudinous parallel lines are diamond-cut into the thin aluminum film covering the grating. These must be precisely shaped so as to reflect light in specified directions . . . a technique called "blazing". By varying the shape of the grooves, gratings can be made for differing needs with their function confined largely to the analysis of materials having definite wavelengths.

Used industrially in the analysis of design materials, the diffraction grating has become indispensable to advanced research in various fields.



Ruling a grating. The disc being ruled rests on large blanks, and the ruling diamond is suspended from the carriage at left and impinges on glass. Curved rod at right is used to lift diamond for return stroke, since ruling is done in one direction only. Many of the operating parts are floated in mercury as added protection against vibration.

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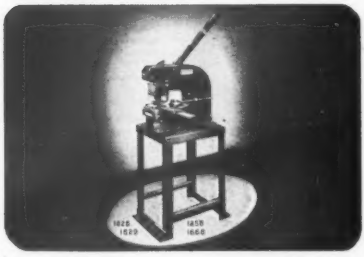

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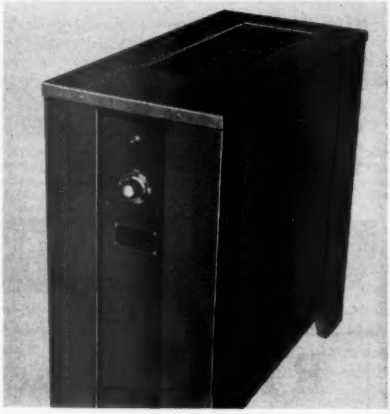
Low Temperature Strippable Plastic

A new strippable plastic coating for packaging airplane, tank and gun parts, and machine tools, has been invented by E. A. Evens, President of Evens-Thompson Mfg. Co.

This new strip coat can be stripped from metals at 40° below zero and, likewise, has passed all drop tests that could be



concocted by the engineers at a leading laboratory at temperatures ranging from 65° to 90° below zero.

Strippable plastic coatings, now in general use, will do an excellent job of protection against corrosion, abrasion and humidity in tropical and moderate climates. Coating compounds now in use have proved practically worthless at temperatures such as are encountered in Korea, the northern United States, Alaska and contemplated arctic bases because temperatures from 60° to 80° below zero are encountered. Extremely low temperature causes all previous coatings to crack and fall off, thus exposing valuable and accurately machined tank and aircraft parts to the corrosive elements of nature.

This new strippable coating easily withstands 100° below zero and can be handled without fear of cracking, or chipping off, due to its remarkable flexibility at extremely low temperatures.

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with
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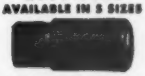
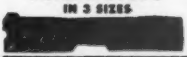
STOP-PINS
AVAILABLE IN 5 SIZES



FINGER STOPS
IN 3 SIZES



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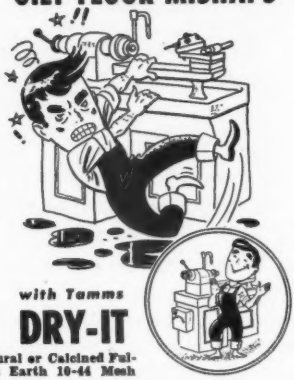

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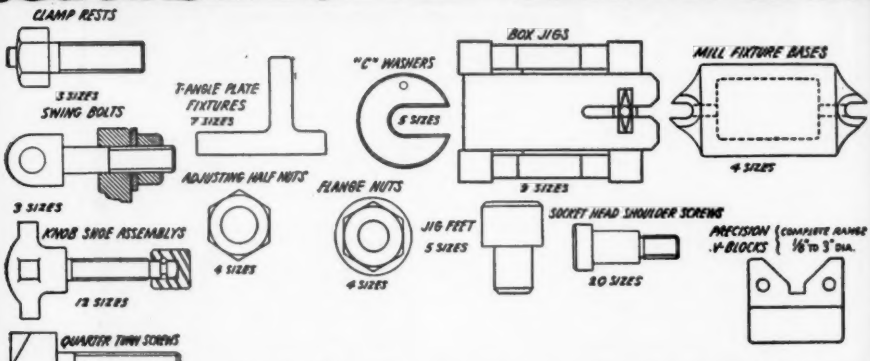

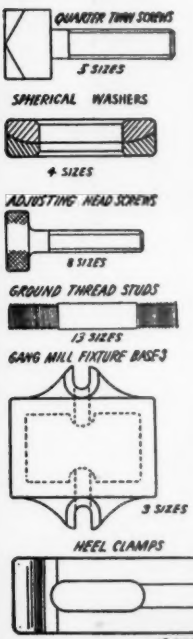

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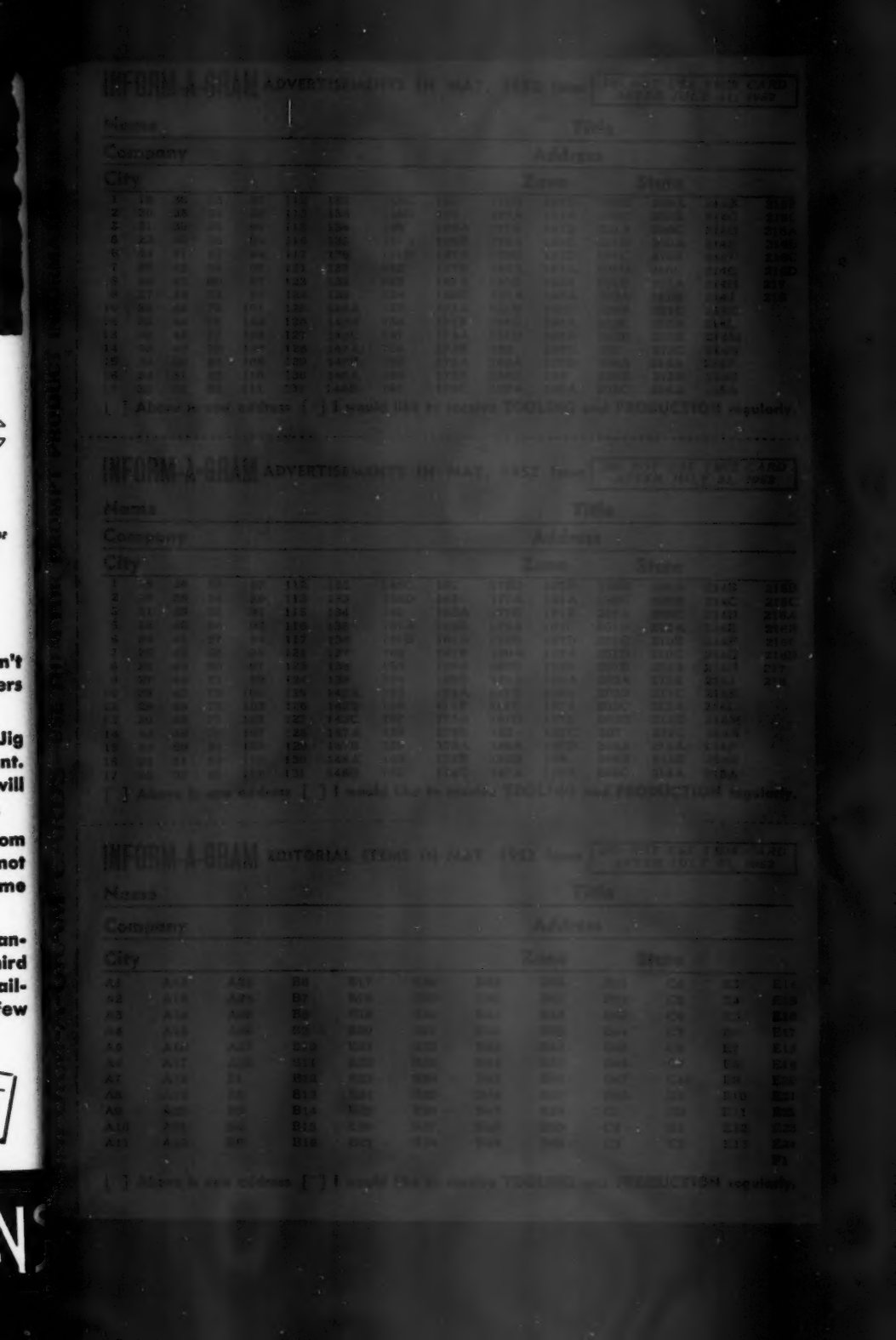

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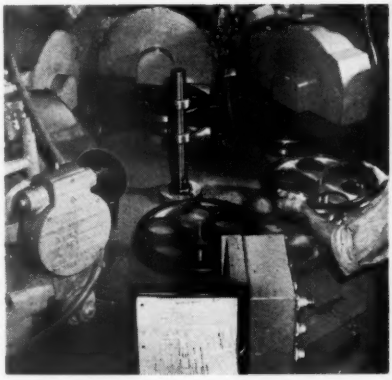
HY-TEN and AISI

Gears Automatically Wire Brushed for Burr Removal

Ring gears, with which starter pinions mesh, are among parts of Fordomatic torque converters machined in the Automatic Transmission plant of the Ford Motor Company, Cincinnati, Ohio.

As in all spur gear production, burrs are left at the ends of teeth when they are cut. To remove these burrs, Ford employs the automatic Acme machine here illustrated. It has six gear holders that are carried around on the circular table as it rotates slowly about a central axis.

Gears are loaded and unloaded by hand as the holders pass through the two front stations of the machine. After passing from the loading stations, the holders, along with the gears they carry, start to rotate slowly about their own axes and continue this rotation until they come to the unloading station. During this transit, the gears pass under four motor driven wire brushes each set at a different angle relative to the gears. In so doing, all burrs are removed by the brushes, leaving the gear teeth deburred, as desired, when the gears arrive at the unloading station. All the operator does is load and unload the gears. About 316 gears an hour are deburred in this setup.



Acme machine set up for deburring ring gears in the Ford Automatic Transmission plant, Cincinnati. Gears loaded and unloaded at front stations are carried under four wire brushes, each set at a different angle.

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WRITE FOR BULLETIN N-10

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

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QUICK-PIC

PLAIN MILLER
Index Model 60 plain milling machine has full No. 1 capacity. Bulletin points up such features as automatic lubrication, 8 selective speeds, simplicity.
Circle No. E5.

POINTING MACHINE
Economy high speed automatic pointing machine performs many secondary operations on typical cold headed products at production rates up to 5400 pcs/hr.
Circle No. E6.

BEARING SURFACES
Bulletin describes a process for improving bearing surface quality by means of high speed, cam-actuated peening rolls that hammer surface at 200,000 blows/min.
Circle No. E1.

GAGE BLOCKS
Catalog describes and lists both steel and Lifetime-Carbide gage blocks, that are lapped by special process that provides a uniform dimensional accuracy.
Circle No. E2.

SAFETY TOOLS
Ampco non-sparking hand tools are listed in booklet, including wrenches, chisels, screwdrivers, hammers, pliers, etc. Size and weight specs are included.
Circle No. E9.

WIRE BASKETS
Hoffman bulletin shows various metal wire baskets, dippers, strainers, and containers for heat treating, metal finishing, anodizing, and other jobs.
Circle No. E10.

ELECTRONIC GAGE
Bulletin gives major points on production gage for repetitive high-precision gaging of one or more dimensions, with instant meter response, low contact pressure.
Circle No. E3.

FAST ROUTING
Precision built motors for fast, accurate routing of non-ferrous and non-metallics are described in bulletin. Portable routers come in kit form, ready for use.
Circle No. E4.

RUSTPROOFING
Bulletin describes Rustshielding, a chemical non-electrolytic process for providing an oil retaining, rustproof surface on moving metal parts.
Circle No. E11.

POWER SHEARS
Hendley & Whittemore catalog presents line of Beloit heavy duty power punches and shears for wide range of operations on very heavy gauge plate, bar, and rod.
Circle No. E12.

MULTIPRESS
Denison's house organ includes studies of savings made in customers' plants by use of hydraulic Multipress, for fast automatic operations.
Circle No. E7.

BENCH MILLER
Circular describes Barker miller that is designed, developed and precision made for the rapid production milling of small parts that must be held to extreme tolerances.
Circle No. E8.

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CATALOGS

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AUTOMATIC TOOLS
Brochure describes many semi-automatic and fully automatic combinations of standard air operated workfeeders, presses, timers, valves, cylinders, fixtures, etc.
Circle No. E17.

FACE GRINDERS
Catalog of full line of Besly-Bowen radial head face grinders, shows 3 basic models for wheel sizes from 6" to 18" dia. Standard fixturing covers wide range.
Circle No. E18.

LATHE CONVERSION
Booklet describes the Newton Automat, a fully mechanical unit for transforming a hand-operated lathe into a production automatic. Standard cams are adjustable.
Circle No. E13.

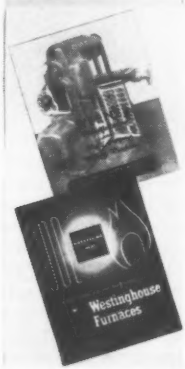
PRECISION PLANING
Clearing's Martin planer is built for higher speeds, greater rigidity, and great strength. Bulletin Emphasizes pyramid housings, double balanced gear train.
Circle No. E14.

DUPLICATING
Peck & Harvey sheet shows how portable low-cost printer delivers exact, positive copies from translucent originals in as little as one minute.
Circle No. E21.

PRESSROOM SHEET FLOATER
Verson magnetic unit separates stacked steel sheets and blanks safely. No electrical or air connections. Data sheet explains permanent magnet use.
Circle No. E22.

TOOLROOM LATHE
Bulletin shows South Bend precision toolroom lathe, which is job tested before leaving factory on all operations to tolerances far more precise than required.
Circle No. E15.

TUBE BENDING
"Bend-Ex automatic tube bender, powered by air cylinder, is described in bulletin. Machine will make over 900 bends per hour, and can be set up in 3 short steps.
Circle No. E16.



PILOT BUSHINGS
Jergens pilot bushings with Timken tapered roller bearings are used for piloting deep-hole boring bars, and other tools thru jigs and fixtures. Data sheet available.
Circle No. E23.

SHOT ABRASIVE
Cleveland bulletin points out advantages of nozzle blast cleaning, centrifugal impact cleaning, and shot peening, using shot of uniform high quality.
Circle No. E24.

MILLING MACHINES
Bulletin describes Werner multi-purpose and manufacturing millers. Machines have many outstanding features which add up to high production, trouble-free service.
Circle No. E19.

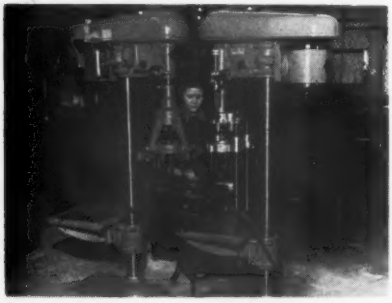
HEAT-TREATING
Selection of furnace most suitable for a specific job is subject of new booklet. Four basic types of protective atmosphere are thoroughly discussed.
Circle No. E20.

SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Bottleneck Broken by Two Ordinary Drill Presses

To eliminate the bottleneck created by the shortage of machine tools, the Lewyt Corporation, contract manufacturers and makers of the Lewyt Vacuum Cleaner, have developed and built an automatic drilling and threading machine which will perform twelve operations simultaneously.

Designed to drill and thread spacer rods for variable capacitors for field communications equipment used by the Signal



Corps, the machine will automatically drill eight holes and thread four of them.

When the need for such a machine arose the firm discovered there would be a sixteen-month delay in delivery, and that the machine would cost $10,000. Due to the nature of the government contracts, Lewyt Corporation could not wait that long for delivery. Instead they designed and built their own machine in four weeks at a cost of only $2,500.

Taking two ordinary drill presses, a rotary indexing table, and eight spindle adjustable drilling head, a four spindle adjustable threading head and an air-powered feed, they combined these elements into a machine with a productive capacity of 360 pieces per hour capable of performing 4,320 operations.

The adjustable features of the unit enable the company to work with six different types of spacer rods, effecting change-overs within a half hour.

By developing this machine and eliminating costly individual operations, the company will save 10,000 man hours of labor. This is based upon a need for a half million spacer rods of six types.

A Convertible Drilling and Tapping Machine

Here is the type of special drilling and tapping machinery which can be easily converted to other uses after it has completed its present job of processing Army tank parts.

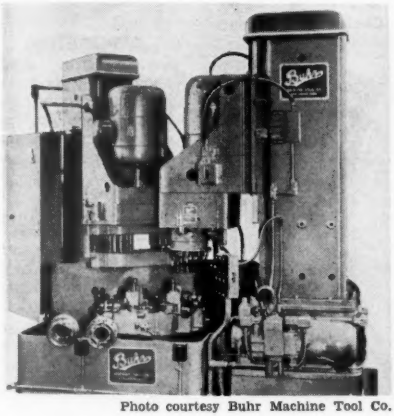
All such special machinery which the Buhr Machine Tool Co is building for tank, air-craft and gun parts, is being designed for utmost flexibility. This will make the conversion of them easy for manufacturing other parts.

A special feature of this machine is that both sides of the workpiece are drilled and tapped in the same fixture, an operation which is accomplished by turning the workpiece over after one side has been drilled and tapped.

Two sets of locators are produced, with a single lever actuating both sets, lowering one set as it raises the other set.

Made for an automotive manufacturer commissioned to manufacture Army tanks, this Buhr Model is a two-column combination drilling and tapping machine which drills, chamfers and taps (12) 9/16-18 holes in each end of the tank part, two of which are shown in the lower left.

Tooling consists of a 24-spindle drill head and a 12-spindle individual lead screw tapping head and one four-station fixture, mounted on a four-position automatic index table.



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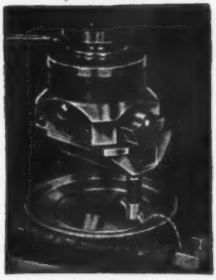

ONE Tool

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Model FS shown performs all die making operations. Equipment includes File Roller Support Overarm in addition to overarm shown.

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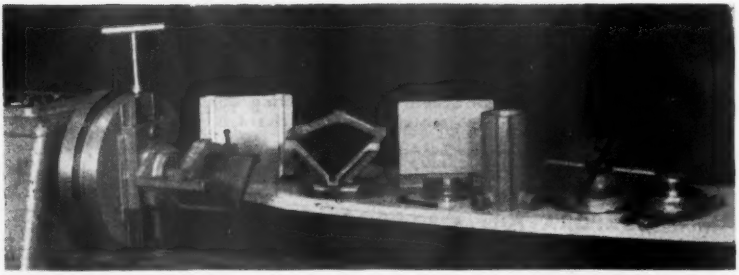
SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Quick Setups For Work Holding



The line-up of machine tool accessories shown above is representative of the work holding tools designed and built by Micro Lathe Plate, Inc. Altho the examples shown here are of engine and turret lathe applications it can be seen that the various fixtures are as readily adaptable to use on the tables of such other machines as drill presses and milling machines. The basic tool is an auxiliary face plate. On this can be mounted calibrated cross slides, v-plates, 90° plates, as well as conventional chucks. These, singly or in combination, can accommodate an infinite variety of workpieces for any number of operations such as turning, boring, facing, chamfering, tapping and reaming. At the left is shown a boring tool in a chuck which can be offset from center so as to take care of a wide range of bore diameters. The illustration below shows a setup consisting of the adjustable face plate plus a v-plate. The simple combination of swinging the v-block and setting the calibrated face plate slide permits bringing (successively) the three locations on the workpiece to the center of rotation and opposite the respective turret tools. These work holding tools are not limited to short run applications. They can be so chosen as to permit fast loading and unloading for highly repetitive operations.

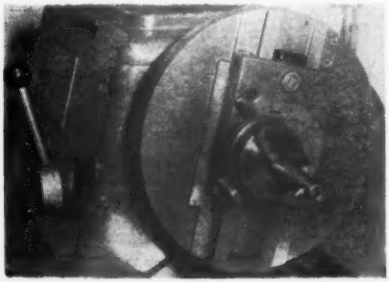
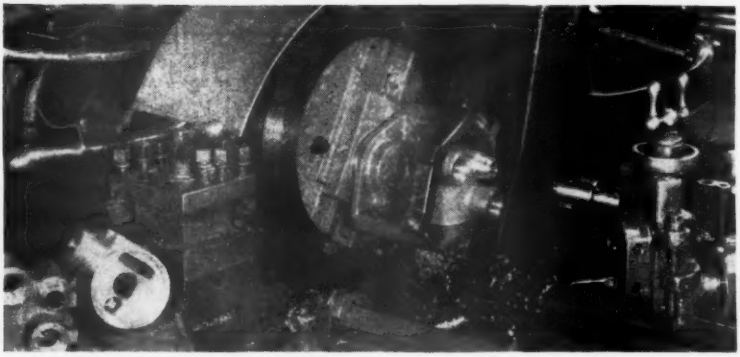


Photo courtesy Wolf Industries.



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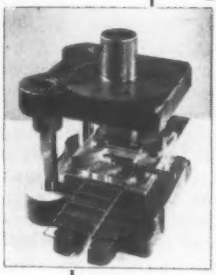
HEAVY SIZE WEST AUTOMATIC DIE STOP



West's Automatic Die Stop is now available in a large size. This Stop works with the same positive action as the old light model which has been in use over 10 years. It features a one-piece arm, built-in coil springs, and hardened steel throughout. Write for descriptive folder and template.

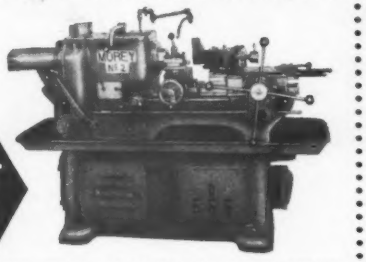
R. C. West Tool & Die Corporation
DEPEW, NEW YORK

For Ease, Economy and Simplicity of Operation

DEPEND ON THE

MOREY

No. 2 TURRET LATHE



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Motor	3 HP

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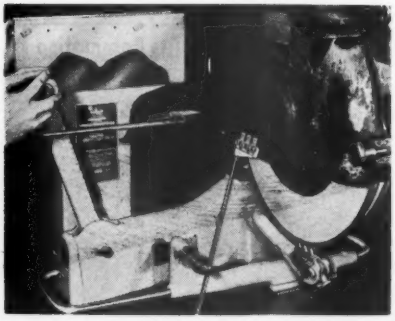
SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Larger Diaform Attachment Developed

A larger Diaform wheel forming attachment has been developed by Pratt & Whitney, Div. Niles-Bement-Pond Company, to simplify the form-truing of grinding wheels up to 20" diameter, used on medium and heavy-duty, horizontal spindle, surface grinders. It offers a quick, accurate method of truing a given form up to 3" wide and 1" deep in one setting. The new unit, similar in design to the popular smaller Diaform introduced in 1949, has been designated the Model 4. Basic construction is a vertical pantograph, which is operated by tracing from a 5:1 ratio template to guide a truing diamond across the periphery of the grinding wheel.

The attachment is portable, weighing approximately 75 pounds, and is placed on



the magnetic chuck or strapped to the table of the grinder. Three diamonds mounted in tandem are employed to true a new form on a wheel: one for roughing, one for semi-finishing and one for finish truing. Whereas the roughing diamond is a natural uncut stone the semi-finishing and the finishing diamonds are chisel shaped and precision ground to .010" radius. A worn finishing diamond is ordinarily used for semi-finish truing, thereby extending the accurate life of the finishing diamond. The diamonds are mounted on the diamond spindle of the Diaform and a centering gage is provided to center each diamond under the grinding wheel for its respective truing operation, by traversing the machine table.

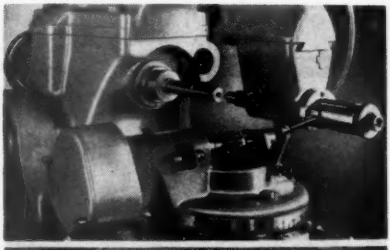
Gear Hobber Offers New Flexibility

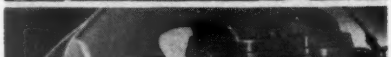
A recent change in the hob spindle assembly design of the Hamilton No. 1 Gear Hobber, as announced by The Hamilton Tool Company, permits 180° rotation of the hob spindle turntable, and reverse rotation of the hob spindle itself, without change of work spindle rotation, or direction of feed. Also, the machine can now use both straight hole hobs and tapered hole hobs with taper either right to left or left to right.

The work spindle and hob spindle can now be reversed independently of each other, and the direction of feed can be changed independent of either. Thus, both conventional and climb hobbing, with either straight hole hobs or tapered hole hobs, can now be done from front to back or from back to front.

This change in hob spindle asembly extends and enlarges the machine's exclusive and popular feature of independent selection of speed, feed, and indexing, and adds a new and desirable flexibility to meet the requirements of quantity producers of small, precision gears.

Hamilton No. 1 Gear Hobbers now in use in industry can be changed over to provide the new flexibility.





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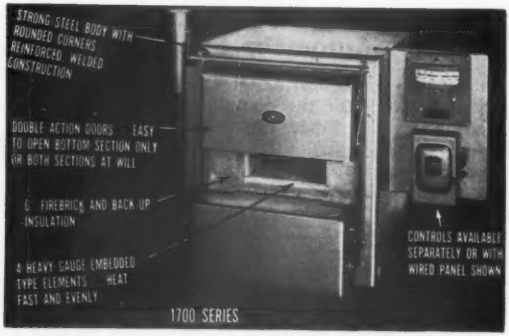
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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

Specialized Attachments Multiply Automatic Screw Machine Applications

As versatile a producer as the automatic screw machine is for the manufacture of turned parts of all kinds, like bolts, nuts, bushings, special pins, fittings, etc., the employment of certain functional accessories or attachments multiplies the variety of jobs which can be turned out. Typical examples of this flexibility are shown here and pertain to the "Traub" line of single spindle automatic screw machines distributed by the Guthery Machine Tool Corporation of New York. The "Traub" is built in four sizes having maximum collet capacities of 19/32", 13/16", 1", 1-13/32", with 12-step spindle

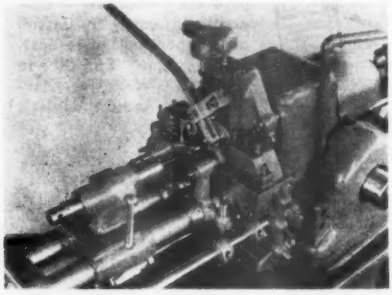


Fig. 1. The specially designed magazine feed can be loaded manually or fully automatically by means of a hopper.

speed ranges of 900/6500; 550/4000; 550/4000; and 200/2500, respectively.

The magazine feed shown in Figure 1 is used for secondary operations. The design of both the feed and the chute depends upon the shape of the parts being run.

The double drilling attachment, Figure 2, for stepped holes, consists of two drilling quills which are brought consecutively on center by a cam on the front camshaft. A double feeding cam operates each spindle and the hole depth, adjustable through stops, maximums at about 1¼".

The threading attachment, Figure 3, involves a threading spindle located in the tail stock quill and powered by a

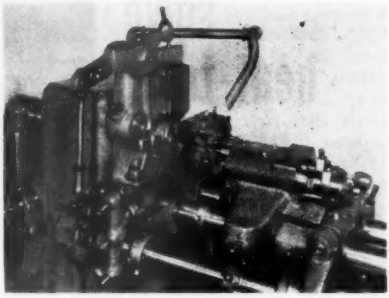
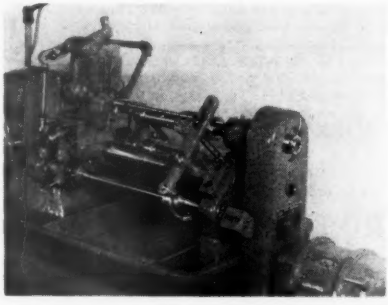


Fig. 2. Stepped diameter holes are produced by this double drilling attachment.

3-step v-belt drive from a separate 2-speed motor. By varying the threading spindle speeds, the main spindle can premanently revolve at constant speed, thus allowing the operation of the cross slides on the (additional) longitudinal turning attachment while threading.

On the "Traub" machine, the front and rear slides as well as the tailstock are guided on hardened and ground guide bars. This type of support has proved to be highly wear-resistant under constant heavy loads. The main spindle is supported in precision ball bearings. Adjustments are provided for eliminating any play.

Fig. 3. A threading attachment produces external threads 5/16" diam., and to lengths of 1½". Longitudinal turning can be combined with threading operations.



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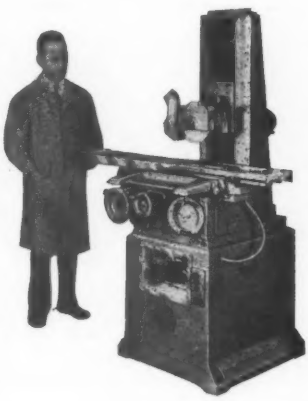

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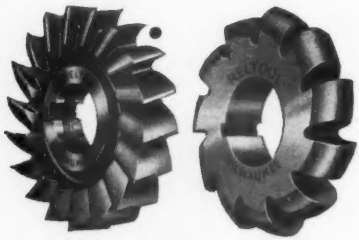

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The new J-47 welding positioner consists of a cradle which is power-rotated through 180° so that welding can be performed on both sides of the assembly. The assembly is carried on a variable-speed rotating spindle and is enclosed by power-operated insulated doors equipped with ports for welding. Thus the operators have clear access to the work and yet are protected from heat and splatter.

The assembly is maintained at 600° F. by means of gas burners controlled by motor-operated gas valves and with manually operated secondary air valves. An interlocking system of electric controls maintains ignition, firing and gas pressure.

Welding speed can be varied as required by means of a special heavy-duty, variable-speed gear reducer designed to withstand the blows of the chipping hammer without injury to the gear train.

While the J-47 positioner is designed for hand welding, it is adaptable to automatic welding of any approved type.

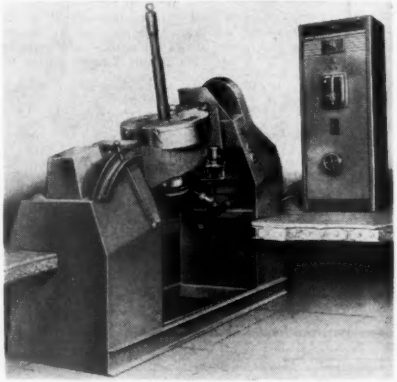

Photo courtesy Syracuse Special Machine Co.

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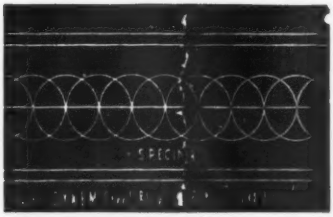

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. . . Ford Axle, from page 70

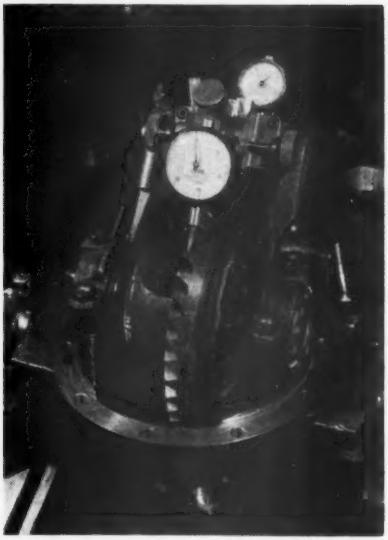

Fig. 11. Assembly fixture setup applied to a conveyor fixture for measuring the backlash between ring gear and pinion and preload on cross bore bearings of a Ford rear axle assembly. Precise measurements are made rapidly and help to insure quiet operation of the product.

are machined. Formerly, the bolts were tightened individually with a nut runner but the job is now done about four times as fast by using four air-driven runners set on correct centers, as shown in Figure 7. A spring takeup counter-balances the weight of the runner.

A similar job is done on ten ring bolts, as in Figure 8, but, in this instance, a five-spindle runner is used, spacing being too close for more. In two applications, however, this unit tightens all ten bolts to the required inch pounds of torque.

After the carrier cases have these bores finished, they are placed on the assembly line shown in Figure 9. There, in one position, the four cap bolts are removed, using a four-spindle runner with reverse motion. This is done to permit insertion of the differential, with its gear already in place.

Subsequently, the assembly passes through another station, Figure 10, where the cap bolts are again applied and tightened, using another four-spindle runner. At another station near the end of the assembly line, the setup shown in Figure 11 is used on the conveyor fixtures to measure the backlash between the ring gear and its pinion as well as the preload on crossbore bearings. Adjustments are measured by the two indicators shown in Figure 11.

Backlash between the ring gear and pinion is measured by the indicator at the front and the rear indicator serves to measure the spread of the pedestals when the specified preload is applied to the differential crossbore bearings.

★ ★ ★ ★ ★

. . . High Speed Camera, from page 80

side, the streak image which is obtained from the gas discharge. It will be noted that the discharge took place before the high-speed motion picture image was recorded. The 1,000 cycle pips seen on the left-hand edge of the film indicate that the picture was recorded at 5,000 per second. The actual discharge took place in practically 1/1000 of a second. The 1,000 cycle pips were put on the film with the 2098B Wollensak generator.

In order to record the cathode ray oscilloscope image, only the plus and minus X sweep are used to record the electrical phenomena. For example, in measuring chatter on a relay, a 10,000 cycle timing wave can be put on the relay contacts. The high-speed picture is made of the relay contacts as they operate, and the timing wave is fed into the oscilloscope so that a continuous wave can be photographed with the side lens. If there is fine chatter, and the camera is operating at top speed, measurements can be made to an accuracy of one microsecond.

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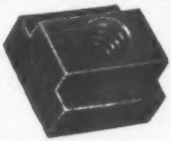

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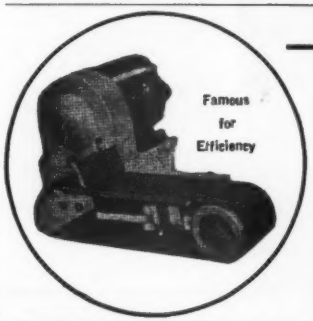

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SEE ADVERTISERS INDEX, PAGE 185, FOR KEY NUMBERS

. . . Keeping Safe, from page 164

F. Personal contact made daily by the foreman and assistant is the best means of selling safety to the employee. A ten minute period each day with the employee will be sufficient in discussing safety "on the job."

G. After being on the job a few days, the new employee is required to attend two meetings. First meeting—A meeting conducted by the training department which consists of Harvester policies, i.e., vacation, E.B.A., Union activities and etc. (Approximately 2 hours.)

Second meeting—A meeting is conducted by the safety department on general safety rules, showing of a safety film, and issuing of a safety rule book. (Approximately 1 hour.) The remaining part of the meeting is conducted by the plant protection department on fire prevention, how to use fire extinguishers and the various types. A demonstration on putting fires out, and a safety film. (1 hour.) Total hours for both meetings is 4 hours.

Safety is a must and should be applied with great concern on the job by the employee throughout his eight hour working period.

during noon hour?.....Does he know where the Fire Extinguishers are and the kind to use for RUBBISH?.....OIL?..... or ELECTRICAL FIRES?.....Has he been instructed as to the proper use of compressed air or steam?.....Will he report unsafe practices to Safety Dealers, or the Foreman?.....

QUALITY

Have you instructed him as to the necessity for "Quality"?.....That it is the foundation of our business?.....How to check his work?.....And to set aside defective parts?.....Have you explained to him about the departmental Quality Log? .....Have you asked for his cooperation to maintain quality?.....

EQUIPMENT

Has the man been instructed as to the proper care of equipment?.....Have you asked him not to abuse same?.....Does he know what it costs?.....and what it is intended for?.....Does he know the proper oil to use?.....Where to oil?..... And how often? .....Does he know he is being paid to clean and oil the machine each shift?.....Do you feel the man has been thoroughly instructed in the above matters?

End of Instruction Period—Date

Second Assistant Foreman's Signature

Checked by Department Foreman—Date

Department Foreman's Signature

This 1½-ton crane, for use in the electrical repair shop of The National Supply Co. plant at Ambridge, Pa., was built by employees of the shop using salvaged materials almost exclusively.

The 80-foot crane runway consists of 6" H-beams formerly used in the machine shop when all lathes were run by overhead motors. The bridge was made of 8" I-beams and some 6" channels salvaged from a gas-producer no longer in use. The only new materials were a piece of steel about 20 feet long and 5 feet wide and end trucks 36 inches wide.

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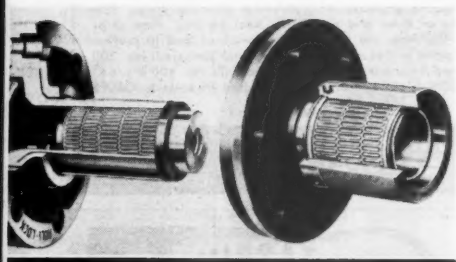
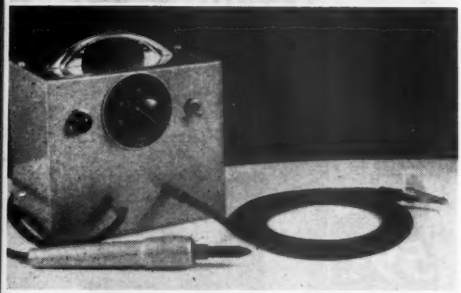
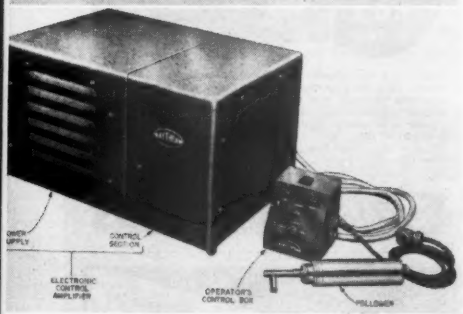
NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS



Chucking to Extreme Accuracy is assured when using one of the newly-introduced "Roll-Lock" Chucks, Expanding Mandrels and Arbors. These permit transmission of maximum torque and thrust. Powerful wedging action of rollers expand or compress the chucking surface to an extremely rigid and accurate centering fit, which is quickly engaged or disengaged by a twist of the actuating ring or cone. Grip cannot be loosened by reversing rotation, by shock, or by vibration. SCULLY-JONES & CO., 1913 S. Rockwell St., Chicago 8.
Circle Inform-A-Gram No. A1.

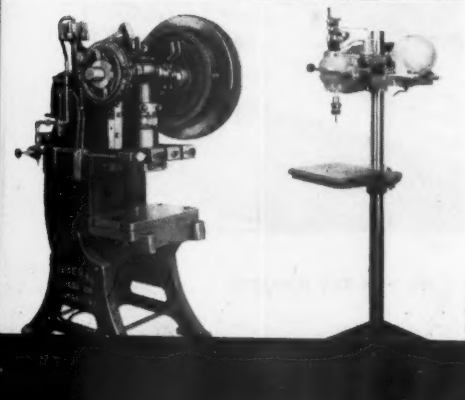


Compact Resistance Soldering Unit with adjustable heat control has many advantages for small assembly and repair work. Control allows electrodes to heat instantly up to 1500°. The replaceable carbon electrode is fitted in a 2-oz. handle of durable, heat resistant plastic. SUNRISE PRODUCTS CO., P.O. Box 173, Hawthorne, N. J.
Circle Inform-A-Gram No. A2.



Irregular Contours Are Reproduced accurately and quickly, using the Single Motion Duplicator. This electronic robot employs a supersensitive follower, a variable reluctance transducer whose electrical output varies in accordance with the contours of a template. This signal is amplified and detected in the control unit providing drive to the output motor. The motor positions the cutting tool, with the contour reproduced automatically on the work. Adaptable to most machine tools. RAYTHEON MFG. CO., Waltham 54, Mass.
Circle Inform-A-Gram No. A3.

Current Line Punch Presses (outside cut) offered by Federal incorporate new clutch-brake mechanism and electro-pneumatic controls. A single solenoid synchronizes the air actuation of brake and clutch. Compressed air expands a rugged rubber-and-fabric tube, engaging the clutch to any "grip" required. Spring-tension brake is released by air pressure. Controls permit single tripping, continuous operation, or "inching". FEDERAL PRESS CO., 1607 Division St., Elkhart, Ind.
Circle Inform-A-Gram No. A4.

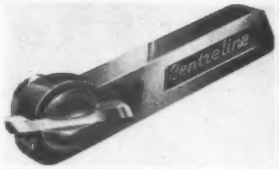


Sustained Thread Accuracy (inside cut) is feature of precision production tapper which is fast and rugged, being built for continuous use. On all types of work, sensitive touch with complete control is provided. Released spindle automatically throws into neutral. Micrometer adjustment permits setting automatic air-stop within .005". Tapping speeds are 95 to 350 rpm. LECKINGER MACHINE & EXPERIMENTAL CO., 716 N. Highland Ave., Los Angeles.
Circle Inform-A-Gram No. A5.

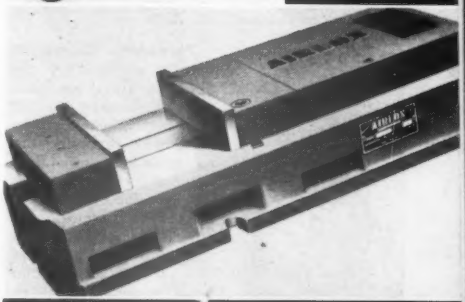
ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

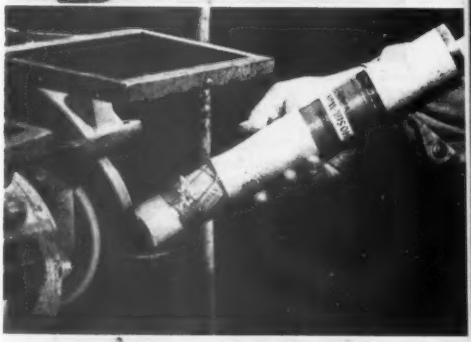
Centreline Tool Holder (inside cut) permits easy adjustment of the angular setting of tool bits used on lathes, shapers, planers, etc. Thus, the need for grinding rake angles on individual tools is avoided. The tool bit is gripped and held in the head of a slotted collet that locates in the side face of the shank. A lock nut on the reverse side draws the collet into a tapered hole, crimping slot faces tightly onto the tool bit. TECHNICAL DEVELOPMENT CO., 22 Meredith Rd., Philadelphia 31.
Circle Inform-A-Gram No. A6.



Cup Packing Expanders (outside cut) eliminate leakage in hydraulic and pneumatic cylinders. The expanders ensure positive sealing action of cup packings by exerting controlled pressure on the packing lip so that it maintains constant contact with the cylinder wall. This line, providing sizes for use with all standard packing diameters from 1¼" to 2⅞", complements HPL's line of strip expanders for use with cylinder diameters over 3". HPL MANUFACTURING CO., 15269 Miles Ave., Cleveland 28.
Circle Inform-A-Gram No. A7.

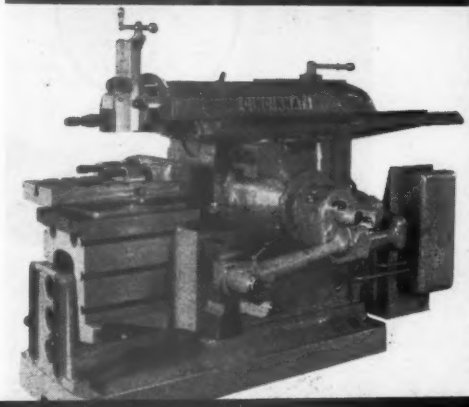


Improved Pneumatic Vise. Airlox Model S-7, gives a grip on the work of 100 times air line pressure. New wider vise body contour with thickened side walls provides a more rugged and rigid vise. Chip plate riding with the movable jaw keeps small chips and dirt clear of moving jaw and out of vise mechanism. Cross keyways align false jaw faces. PRODUCTION DEVICES, INC., Whitehall, N. Y.
Circle Inform-A-Gram No. A8.

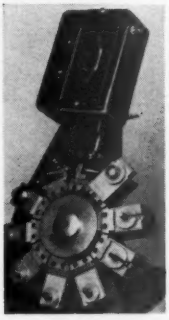


Wax Lubricant in Handy Stick Form is now available. The No. 140 Stik-Wax, a blend of special solid waxes, provides a durable, clean lubrication for metal sawing, sanding, drilling, tapping, grinding, and other common shop operations. Advantages are lubrication-as-needed, plus the usual wax-use benefits such as increased tool life, improved surface finishes, and minimized burr conditions. Industrial Products Dept., S. C. JOHNSON & SON, INC., Racine, Wis.
Circle Inform-A-Gram No. A9.

Instant Starting and Stopping is now provided by electro-magnetic clutch and brake furnished as standard equipment on all sizes of Cincinnati shapers. Clutch and brake operate from a single finger tip control lever, without grab, and are powerful and smooth in action. Instant action permits fast and accurate positioning of ram for setting tools. Virtual freedom from maintenance is an advantage. THE CINCINNATI SHAPER CO., Hopple & Garrard Sts., Cincinnati 25.
Circle Inform-A-Gram No. A10.

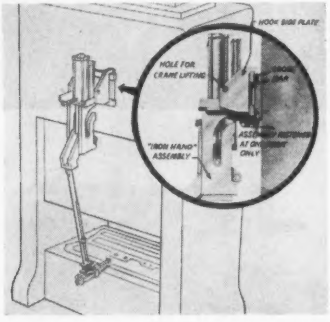


Cam Acting Vise for high speed production holds light work with secure grip. With 2" reinforced fibre jaws that will not chip or burn, vise is ideal for soldering and light electronic assembly. Vise mounted on Junior Powrarm as shown permits fast positioning of work at any angle. Powrarm holds up to 24 lbs. work weight without deflection. WILTON TOOL MFG. CO., 925-41 Wrightwood Ave., Chicago 14.
Circle Inform-A-Gram No. A11.

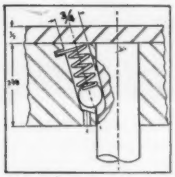


Production Control of Quality is aided by use of Sigma Turret mechanical comparator, which has only one measuring head with revolving turret including adjustable fixtures for checking up to 10 dimensions per workpiece. Fixture capacity is 2" approx. Accurate to 4 millionths of an inch, comparator head is mounted at incline on pedestal fitted with 10-station indexing turret. Limits of tolerance are clearly defined. COSA CORPORATION, 405 Lexington Ave., New York 17.
Circle Inform-A-Gram No. A12.

Transfer of "Iron Hand" Press Unloader from one press to another is now a matter of minutes, due to the new mounting arrangement recently announced. Mounting is fastened and



locked at one point only. SAHLIN ENGINEERING CO., Birmingham, Mich.
Circle Inform-A-Gram No. A13.

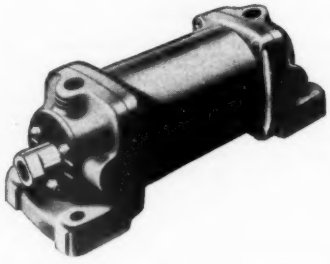


Extra Heavy Duty Punches, for piercing 3/8" or heavier plate, are interchangeable and quickly inserted or removed. A 3/4" ball lock provides increased stripping capacity and also ensures positive radial alignment without the need for using other keying devices. RICHARD BROTHERS DIV'N, Allied Products Corp., Detroit 23.
Circle Inform-A-Gram No. A14.

Carbide Tipped Indicator Points furnished to print specifications, or tips brazed to the customer's points, are made possible by newly developed method of controlled brazing. Method creates a firm bond between carbide tip and steel body, without a buildup of brazing strain in the carbide. Carbide-tipped indicator points exhibit a long life of consistant accuracy, with a high resistance to wear. EASTERN TOOL CO., East Hartford, Conn.

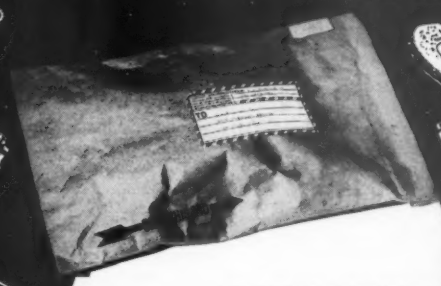
Circle Inform-A-Gram No. A15.

New Line of Air Cylinders comprises 28 different models, each in 9 bore diameters. Air cylinder follows design of Rivett hydraulic cylinder by using keeper rings to hold covers together instead of conventional tie rods, permitting covers to be rotated when desirable.



For pressures up to 150 psi, cylinders come in lengths up to 96". Other features include bronze rod guide, heavy-duty alloy covers, self-adjusting composition cup packing, and self adjusting composition rod packing with seal effect proportional to cylinder pressure. RIVETT LATHE & GRINDER, INC., Brighton 35, Boston, Mass.
Circle Inform-A-Gram No. A16.

SAVE UP TO 76% PACKING TIME!



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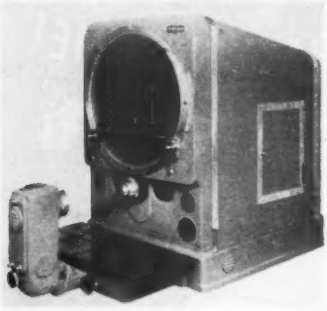
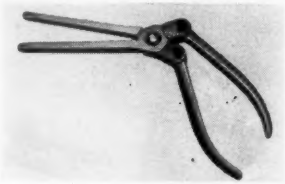
Production Type Optical Comparator, "Olympic" Model B-50, may be used anywhere in the shop under prevailing light conditions without the need for extra screen covers or hoods.



One feature is the plain horizontal work stage platform, 6" x 16", on which production type fixtures may be readily mounted for various classes of work. The 16" dia. image screen also provides for the mounting of overlay chart holders to facilitate chart changing. Condenser lens unit is exhaust power cooled and the light source may be used with color filters to vary the intensity and shading of light on the screen. Objective lens elements used provide maximum light, large objective areas, and sharp definition at all powers. Six magnifications from 10X to 100X are available as standard. PORTMAN INSTRUMENT CO., 6 Manhasset Ave., Port Washington, N. Y.

Circle Inform-A-Gram No. A17.

Light Alloy Safety Tongs for press and shear hand-feeding operations are designed to crush if accidentally caught within the die opening. Thus, damage to press tools or shears is avoided. Made of specially-alloyed magnesium, the new tongs feature fully adjustable handles to

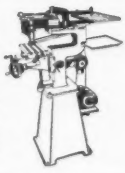


provide greater ease and flexibility in the handling of materials. Tongs adjust instantly to any desired position, with tension at points of adjustment automatically maintained. MAGLINE, INC., Pinconning, Mich.

Circle Inform-A-Gram No. A18.

THE NEW 2D-4
PANTO ENGRAVER
HAS LONG REACH

Will do Pantographic reductions from 1:1 full size to infinity. Perfect for Steel Stamps, Dies, Large Panels, Signs, Masters, Name Plates and General Engraving.



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has been done with the SCLEROSCOPE
since 1907

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You Need an Extra Hand Now to Speed Up Production!

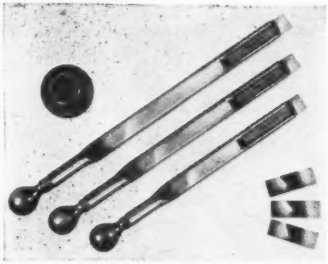
HEIMANN TRANSFER SCREW SETS

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench—no other tools needed. Get more work now—save money too!

IN 11 SIZES—No. 6 to 1" N.C. In all S.A.E. sizes.

HEIMANN MFG., CO. ● URBANA, OHIO

New Hand Scraper for flat surfaces is constructed of seamless tubing, for light weight and desired flexibility. Model #5 scraper uses replaceable blades—high speed steel or cemented

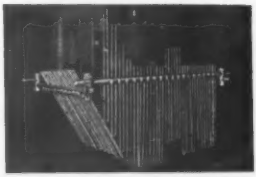


carbide. It is available in 3 lengths, and with rubber body pad optional. ANDERSON BROS. MFG. CO., 1907 Kishwaukee St., Rockford, Ill. **Circle Inform-A-Gram No. A19.**

High Speed Production of Precision Castings is offered by mechanically-operated induction furnace, which transfers molten metal from furnace to mold in any pre-set cycle, usually only a few seconds. Temperature and analysis can be controlled within extremely close limits.

Electro-magnetic stirring unit assures even distribution of elements throughout the melt. AJAX ELECTROTHERMIC CORP., Trenton 5, N. J. **Circle Inform-A-Gram No. A20.**

ADJUSTABLE ROD GUARD
for Power Presses



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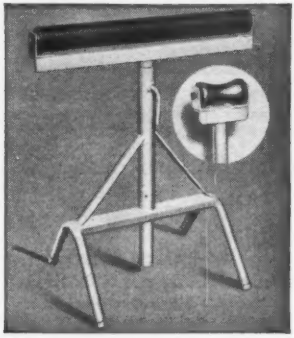
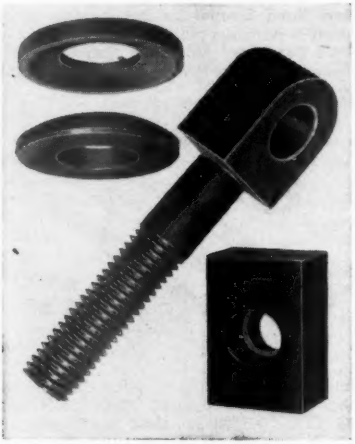
Convenient Support for Free End of shapes, bars, pipes, etc., in punching, shearing, sawing and other work, is provided by new portable roll stands. One type has a straight roller 12" or 18" long for flat shapes and bars. A second type has a concave roller 5" long, for round pipes, rods, bars. Rollers are equipped with grease sealed ball bearings for easy movement



of heavy shapes. SAMUEL OLSON MFG. CO., 2423-27 Bloomingdale Ave., Chicago 47.
Circle Inform-A-Gram No. A21.



Jig and Fixture Components recently added to extensive line include latch bolts in sizes 3/8-16, 1/2-13, and 5/8-16; spherical washers from 1/2" to 13/16"; and fixture keys in same size range. NORTHWESTERN TOOL & ENG'G CO., 116 Hollier Ave., Dayton 3, O.
Circle Inform-A-Gram No. A22.

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of Low Cost Precision
DIE CUT STAMPINGS
IN SMALL LOTS
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TURRET LATHES
5-Tool Tail Stock Turret
Four sizes up to 24" swing
TODAY Send for Folder
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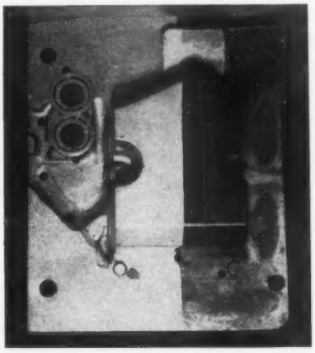
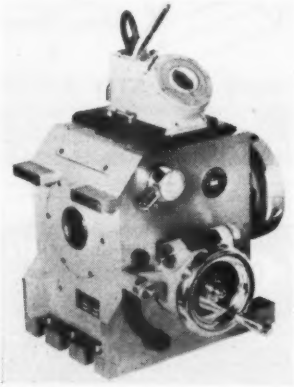
Wet Blasting Process permits effective and safe cleaning of intricate die-casting die with deep holes and thin-walled sections. Abrasion can be controlled to tolerances as close as



.0001". AMERICAN WHEELABRATOR & EQUIPMENT CORP., 1183 S. Byrkit St., Misawaka, Ind. **Circle Inform-A-Gram No. A23.**

The Griswold Optical Dividing Head with a fixed base was developed for use in inspection applications and as a production tool. It is a simplified version of the OPL Universal Dividing Head, employing the same optical system, but with a fixed base so that the spindle of the head is always parallel to the surface on which the head is mounted. It can be used for checking angular dimensions such as the



spacing of spur gear and ratchet teeth, measuring eccentricity and contours of cams and other shapes, etc. F.T. GRISWOLD MFG. CO., 305 W. Lancaster Ave., Wayne, Pa. **Circle Inform-A-Gram No. A24.**

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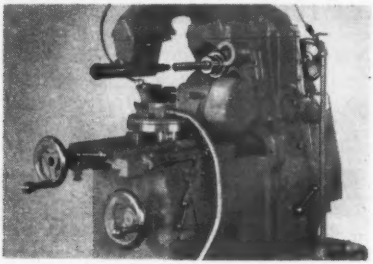
No. 1 Gear Hobbers now feature a draw bar collet operated by a hand wheel. Much faster and easier to operate, this new collet boosts the machine's production by reducing the time



required for loading and unloading. An additional feature of the new spindle design is the adjustable spindle nose, which ensures trueness of the workpiece to within .0001" and simplifies the necessary adjustment for trueness when a change is made from collet to work holding fixture. Principal feature of gear hobber continues to be the independent selection of speed, feed, and indexing. THE HAMILTON TOOL CO., Hamilton, O.

Circle Inform-A-Gram No. A25.

"Shorty" Pneumatic Grinder is compact, easy to handle, and highly accurate. Exceptionally powerful for its size and weight, it is designed for production grinding and finishing where extreme accuracy is required. Features include chuck guard; noise silencer that eliminates high pitch tones; exhaust that directs air toward the wheel to cool and clean the work. It can be

used with abrasive wheels and points, rotary files, carbide burrs, brushes, discs, etc. MALL TOOL CO., 7725 S. Chicago Ave., Chicago 19.

Circle Inform-A-Gram No. A26.

EXTRA HARD! EXTRA TOUGH!
Longer Life Between Grinds!
for.. Die Sinkers
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Duplicators
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Strap Clamps
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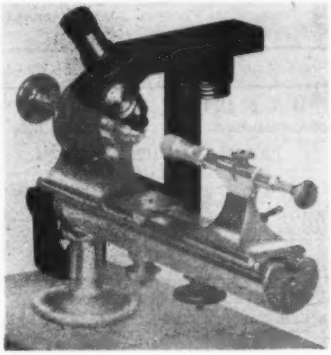

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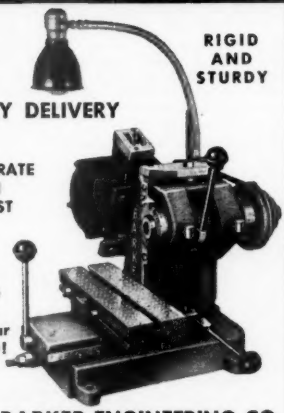

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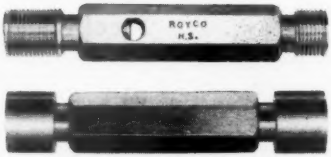

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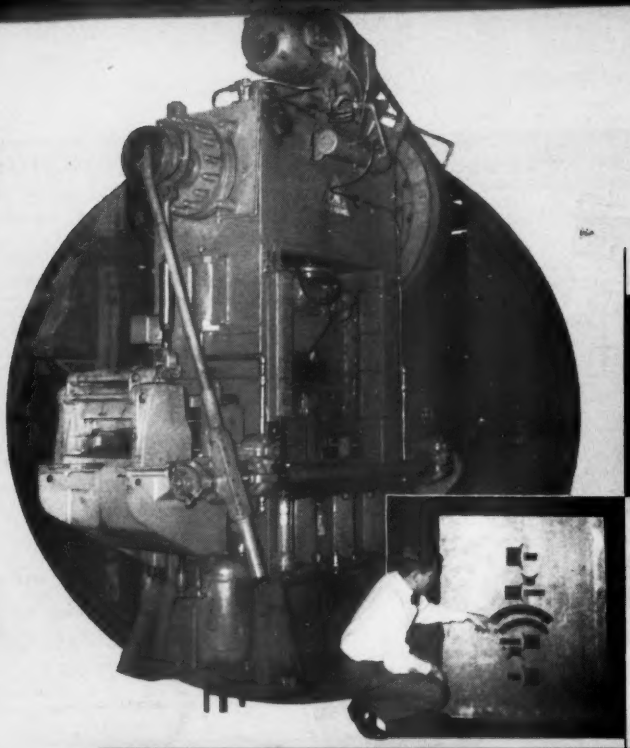

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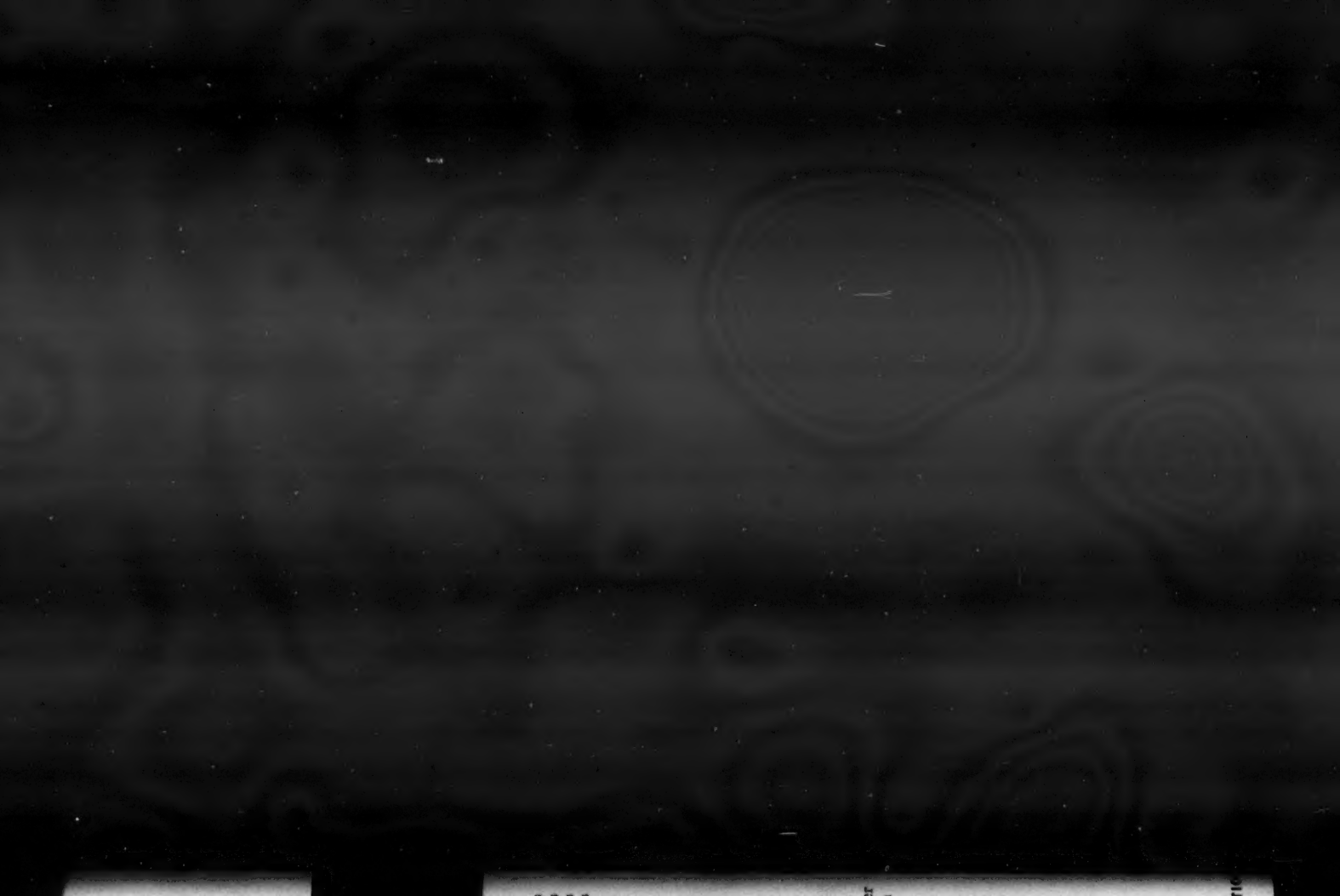
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